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CONSTRUCTION AND EQUIPMENT

No. 32

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CONSTRUCTION

POLICIES FOR FORMING 'ATOMMASH' PRODUCTION COLLECTIVE DESCRIBED

Moscow EKONOMICHESKAYA GAZETA in Russian No 1, Jan 81 p 9

[Article by Valeriy Grigor'yevich Pershin, Deputy Minister of Power-Machine Building and General Director of Volgodonsk's Atommash production association: "In the Making"]

> [Text] Atommash is still being built, but it is already in operation. Its collective came out with the patriotic initiative to promote competition under the motto, "Let Us Built It Ahead of Schedule, Let Us Master It Ahead of Schedule!" Fabrication of the vessel of the first nuclear reactor that the collective committed itself to producing by the 26th party congress is being finished--in production space that has already been turned over for operation.
>
> V. G. Pershin tells in the article about the forming of the giant plant for making equipment for AES's and about the formation of its collective.
>
> Valeriy Grigor'yevich Pershin is the Deputy Minister of Power Machine Building and General Director of Volgodonsk's Atommash production association. After graduation from the Leningrad Polytechnical Institute in 1956, he worked as a foreman, chief of a department, secretary of a party committee, deputy chief engineer, and general director of the Zvezda production association in Leningrad. V. G. Pershin is a candidate of engineering sciences.

For several years now the Soviet people's attention has been riveted on Volgodonsk. The Atommash plant is being erected and will operate here. The enterprise, we shall say it frankly, is unique. Unlike other plants that make equipment for nuclear power stations, flow-line technology for producing reactors is being introduced here.

There has been nothing like it before in world practice in the production of reactor equipment. It is not out of place to note also that Atommash's production space comprises 1 million square meters. Atommash has been called upon to produce the most modern equipment for AES's at minimum cost and in record time, and it is itself a coagulum of advanced thought, of all that has been achieved by domestic science and engineering practice and by advanced domestic and foreign experience.

An Outstripping Pace

Special machining, welding, forging, pressworking, thermal and other equipment has been and is being installed in the plant's buildings. A test-laboratory base that makes wide use of nondestructuve monitoring methods, using X-ray installations, linear accelerators and other apparatus, is being established. Air conditioners are being installed that will create the required microclimate in the departments. The complexity of production and the high degree of reliability of products for AES's required special measures that would provide a somewhat higher air pressure within buildings, in order to prevent dust getting into the production premises. At Atommash, high sophistication and purity are inherent specifications for production.

Even the choice of Atommash's building site, on the shores of the Tsimlyansk Reservoir, provides the enterprise with rare prerequisites: the plant is enabled to transport its products by waterways, which practically removes restrictions on the dimensions and weight of the products.

The equipment that Atommash produces is to work under harsh conditions--high temperatures and pressure and penetrating radiation. And so, concern about quality and reliability, beginning with the first industrial operation, is the main thing for us. The design calls for wide use of computer technology in engineering and economic analyses and in the control of technological processes and of the association as a whole.

The use of an electronic equipment complex enables results to be recorded simultaneously with the conduct of the comprehensive tests and monitoring operations that are conducted on the parts and components of nuclear equipment, beginning with acceptance monitoring. Thus, when the production of any assembly is completed, we will have completely objective data that characterizes comprehensively the level of its quality.

The draft of the Main Directions for the Economic and Social Development of the USSR During 1981-1985 and During the Period up to 1990 states the necessity for developing nuclear power at an outstripping pace. Atommash is one of the active participants in the solution of this task.

Atommash is modern and, at the same time, it has a great future. Supplied with multipurpose equipment, it possesses great flexibility which enables nuclear equipment of improved or even of new design to be put into production in the future at minimal expense. Atommash creates new and favorable opportunities for scientific-research and design institutes and for the whole scientific world in the further development of nuclear machinebuilding.

It is not customary for us to design a plant and to erect it simultaneously. Such a speedy method gives rise, naturally, to some difficulties. We do not always have the technical documentation on time, and we are not always successful in ordering and getting equipment. But, nevertheless, the method of simultaneous design and construction yields a great gain in time.

The plant itself, the methods of building it, the technology that it incorporates, and the equipment itself, which is designed in accordance with the technical requirements, is unlike anything that we have encountered previously. This places high responsibility on our collective. If the people and the state have decided to build such an enterprise and to allocate colossal resources to it, then each of us should do everything possible to see to it that the plant will be on the forward edge of science and technology for many years.

But it is not only technology that will determine the life of Atommash. There are many other areas which, if not taken into account, will prevent us from organizing production properly. For example, the sphere of control. It is not for nothing that a decree of the CPSU Central Committee and the Council of Ministers directed our attention to improving the economic mechanism. We have worked out and are introducing a control system that will allow a minimum of staff personnel and a maximum of effectiveness of control. We are striving to use more completely the experience gained in this respect by VAZ [Volga Motor-Vehicle Plant], KamAZ [Kama Motor-Vehicle Plant] and leading enterprises of power machinebuilding, and we have worked out the standards that will form the basis for organizing control.

Forming the Collective

A modern plant, especially one such as Atommash that is entering life does not consist entirely of economics and production. It consists primarily of people, a collective of many thousands, who must, from the first, be selected, brought together, organized and guided toward the solution of a task most important to the national economy. This problem is no less complex than that of designing a specially built plant. Right now the collective numbers some 12,500 people, and it will double in the near future.

At first workers and specialists came to us from the Krasnyy Kotel'shchik plant at Taganrog. The department for nonstandardized equipment that was formed from them at the end of 1976 thereby became the vanguard to which, for a long time, other laboring collectives of Atommash were compared. And then workers came here from Chelyabinsk and Sverdlovsk, from the Ukraine and the Baltic. Different people arrive at the plant: both those who are currently masters of their jobs, and those just graduated from VUZes, tekhnikums and secondary schools. So now we face fully the problem of training personnel.

Leningrad assisted us greatly here. We, the nuclear machinebuilders, feel a special gratitude toward our comrades in labor, the Leningraders. Shoulder to shoulder, they participated with us in the difficult matter of setting up the plant and forming the collective. The Izhorites sent us design-development documentation and production experience. They sent Atommash a large number of boiler-shell blanks. The production associations of the Leningrad Metals Plant and the Neva Plant imeni V. I. Lenin make nonstandardized equipment for Atommash. Many of our plant's workers went to Leningrad enterprises for apprentice training. Lengiproenergomash [Leningrad State Institute for Power-Machinebuilding Design] and Leningrad Design Institute No 1 have been engaged in the development of and are continuing to improve Atommash's design.

The main, leading trade at our plant is that of welder. In order to begin the first operations for fabricating reactor equipment, the plant trained 155 welders, to qualify them to work in basic production. It was the plant which trained them because even the most experienced welder of ordinary qualification cannot do welding of reactor component equipment right away. Special training is needed. For example, N. Golovin came to us with colossal experience: he had recently welded pipeline in the North. But even here--a specialist of the highest skills--he was given working papers only after he had passed a special training course.

Installations for doing inside and outside welds and manual electric-arc welding and semiautomatic welding machines have their peculiarities. Moreover, not every welder has to weld parts 5 meters in diameter with walls up to 300 mm thick. A nuclear reactor is produced with a guaranteed life of 30 years. And the quality and reliability of the equipment depend primarily upon welding. This is why permission for work on the fabrication of a reactor is an evaluation not only of the worker's vocational mastery but also of his moral qualities.

The mature collective places common interests above all, lives by them, and achieves successes. At Atommash these are the collectives of the departments of vessels and nonstandardized equipment, welding operations control, and the power-engineering department. Their party organizations, in persistently carrying out 25th party congress decisions and the requirements of the CPSU Central Committee decree, "On Further Improvement of Ideological and Political Education Work," are doing much to develop the creative activity of the workers and their career growth. From this comes high conscientiousness and responsibility for the job entrusted to a person. We have been able to form militant party collectives in practically every department, in each section and brigade.

The Training of Personnel

The selection and education of supervisory personnel plays an invaluable role in the formation and further development of the collective. We attribute paramount importance to all areas of economic, party and political education work, and politically mature persons who know their business and are capable organizers have been put in charge. Major, complicated tasks face the plant's collective, and they urgently require that supervisory personnel possess to perfection modern methods of control, have a feeling for what is new, and see the prospects for development.

The plant's management and the party committee always worry about such problems as: who is in charge of technical progress and the organization of production, do we have enough engineers and technicians with the proper skills and production experience, are they sufficiently educated and trained, and do they meet the high requirements that Atommash's unique production work sets. This is why the certification of engineers, technicians and supervisory workers was done at the enterprise. It must be said that the records of the certifying commission contain such entries: "Considered not suitable for the position occupied." This means that the personnel section should choose a specialist for the work in accordance with his knowledge and organizing capabilities.

Atommash needs wageworkers, engineers and technicians of very high skills. Almost 80 percent of the wageworkers have higher, secondary or technical education, and half of them are in the 5th or 6th skill categories. It would seem that Atommash has at its disposal the required number of qualified and educated personnel and there is no reason to worry. However, experience has shown that on the job everything is more complicated, that one cannot judge personnel composition just by the figures cited, that personnel must be checked on a concrete, actual job. That is why the problem of personnel disturbs both the economic supervisors and the party committee of the association.

It would seem that the existing source for augmenting the worker cadre--the orgnabor [section for recruiting and resettling workers], with the assistance of the oblast ispolkom labor administration--should be preserved in the coming years. It is necessary also to further improve the work to attract skilled workers to Atommash and to retain them. For indeed there are also other important national-economic facilities that are mentioned in the CPSU Central Committee's draft for the 26th party congress, "The Main Directions for Economic and Social Development of the USSR During 1981-1985 and During the Period up to 1990."

The task of establishing our own base and system for training and teaching wage-workers, engineers and technicians has risen up before us. The most rational way to train young skilled workers is the PTU [vocational and technical school]. One such school is operating at the plant, and another two will be established.

The specific direction in the work with personnel at Atommash is to retrain and to raise the skills of workers who already have a fairly high skill level but who do not possess the necessary work habits for making equipment for AES's. The council of brigade leaders, under the chairmanship of A. Savranskiy, has promoted active work on the study of advanced experience at like-type enterprises. At his initiative, several groups formed from workers and element and brigade leaders have gone to other enterprises. Direct contacts with comrades in labor have enriched the Atommashers with those subtleties of the work that you do not find in a textbook.

The country's VUZes, particularly those of Rostovskaya Oblast, should be one of the main sources for manning the plant's departments and services with engineers. The Novocherkassk Polytechnical Institute and our branch of it at Volgodonsk have at their disposal especially great potential for this purpose. It is already training engineers in four specialties for Atommash. The question of creating several more new departments in the branch is being resolved.

The steps that Atommash has taken are the steps of establishment, with all their difficulties.

However, now these problems are gradually becoming second priority, having been replaced by operating and technical concerns. In Atommash's portfolio of orders for the 11th Five-Year Plan is the shipment of outfitted reactor equipment for the Yuzhno-Ukrainskaya, Kalininskaya, Rostovskaya and other AES's. In 1981-1985 we are to fabricate, altogether, 7 sets of a million kilowatts each.

It stands to reason that the fulfillment of this task is tied in with the introduction of a number of facilities and mastery of the output of new outfitting facilities. The movement, "Let Us Build It Ahead of Schedule, Let Us Master It Ahead of Schedule!" remains urgent for us also during the 11th Five-Year Plan.

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CONSTRUCTION

MAIN FACILITIES DUE FOR STARTUP IN 1981 ENUMERATED

Moscow EKONOMICHESKAYA GAZETA in Russian No 1, Jan 81 p 11

[Article by Deputy Chairman of USSR Gosstroy Ivan Aleksandrovich Ganichev: "The Program for Facilities Due for Startup During 1981"]

> [Text] Deputy Chairman of USSR Gosstroy Ivan Aleksandrovich Ganichev comments on the map [not reproduced] of the most important construction projects that are due for startup during the first year of the 11th Five-Year Plan.

The CPSU Central Committee's draft for the 26th party congress has found a lively response in the hearts of the Soviet people. Our economy and the material and cultural standards of living are reaching new heights. Successful achievement of the goals set for the 11th Five-Year Plan and during the coming decade depend to no small extent upon fulfillment of the 1981 construction program. The facilities that will go into operation at the start of the five-year period have been called upon to provide for the national economy's requirements for diverse products that are produced at the highest technical level.

In 1981 capital investment from all financing sources will be 140.2 billion rubles. As was noted during the USSR Supreme Soviet session, this is 4.5 percent more than last year's total. State appropriations are being increased by 5.2 percent and will reach 124.1 billion rubles.

The structure of capital investment is being improved. The share therein of expenditures for equipment will increase to 39 percent. Eleven percent more funds were allocated in 1981 than under the plan for 1980 for reequipping plants with machinery, and for rebuilding and expanding existing enterprises.

The planning of capital construction and of industrial production as a single whole that ensues from party and government decisions to improve the economic mechanism predetermined that first priority in the allocations of funds go to the reconstruction and the reequipping of existing enterprises. It is this path that can achieve maximum yield at minimum capital investment.

New construction projects are desirable only where there is no other opportunity for increasing output that the national economy needs. Thanks to the more complete involvement of internal reserves and to technical reequipping and rebuilding, growth in capacity will be provided in 1981 for all branches of the national economy. Not by accident is it that among the most important facilities due for startup during the first year of the 11th Five-Year Plan are newly built enterprises that are neighbors to already famous veterans of our industry, mainly machinebuilding plants.

The map published shows only the most important and the largest startup facilities for the first year of the 11th Five-Year Plan. It is at these construction projects that forces and funds are now being concentrated. It should be noted that the number of facilities being erected simultaneously in 1981 has been substantially reduced. The task has been set of reducing during the year the amounts of uncompleted construction above the norm by 14.9 billion rubles and bringing into play 2.7 billion rubles' worth of uninstalled equipment from reserves that are above the norm.

The Fuel and Power Complex

In comparison with the plan for last year, capital investment for facilities of the fuel and power complex will rise by 9.4 percent. In 1981 the generation of electricity is to be brought up to 1,335 billion kw-hr, and 610 million tons of oil and gas condensate, 458 billion cubic meters of natural gas and 738 million tons of coal are to be extracted. Construction workers will play a great role in developing the fuel and power complex.

The map shows the Kurskaya Nuclear Power Station, where startup of a third power block with a capacity of 1 million kw is called for, the Ryazanskaya GRES, at which a 800,000-kw turbine will be introduced, and the Sayano-Shushenskaya GES, which will be augmented by 6 hydroelectric units of 640,000-kw capacity each.

It is planned to introduce the 5th and 6th power blocks of 500,000 kw each at the first GRES of the Ekibastuz Fuel and Power Complex. Turbines of 300,000-kw capacity each at the Stavrolpol'skaya, Azerbaijanskaya, Zuyevskaya (Donetskaya Oblast) and Syrdar'inskaya GRES's, of 210,000 kw capacity at the Primorskaya GRES, and high-capacity heat and electric-power centrals at Cheboksary and Blagoveshchensk will yield current. The first 200,000-kw units at the Kurpsayskaya GES in Kirghizia, as well as four 78,000-kw turbines at Nizhnekamskaya GES in Tataria, and one of the same capacity at the Cheboksarskaya GES, will be put under load.

In all, about 10 million kw of energy capacity will go into operation on electric-power station turbines during the year. This is more than 5 GOELRO [State Commission for the Electrification of Russia] plans.

The map acquaints the reader with the Punga-Ukhta-Gryazovets-Torzhok pipeline, more than 1,500 km long, and the Urengoy-Petrovsk (about 1,300 km long), which will transmit additional streams of West Siberia's gas to the country's Central Economic Region. The Tyumen'-Yurgamysh, Perm'-Al'met'yevsk, and Krasnoleninskiy Anticline-Shaim central oil-collecting point in Tyumenskaya Oblast will be laid.

Large-capacity coal-mining facilities are planned to be turned over to the underground mines Dolzhanskaya-Kapital'naya (3 million tons) and Voroshilovgradskaya No 1 (750,000 tons) in Voroshilovgradskaya Oblast, and the Berezovskaya Underground Mine (1.5 million tons) in Tul'skaya Oblast, and also to the Kiselevskiy Strip Mine (500,000 tons) in Kemerovskaya Oblast.

Startup of the first phase of the Achinsk Oil Refinery in Krasnoyarskiy Kray, with capacity for primary refining and for catalytic re-forming, is called for.

Bulk Chemicals

It is planned to turn over new production facilities for the coking of heavy crude residues and the deparaffinization of diesel and kerosene fractions at the Volgograd, Krasnovodsk, Novyy Baku, Mozyr' and Polotsk oil refineries.

Improvement of the structure of the country's fuel balance will enable hydrocarbon raw materials to be sent in large amounts for intensive refining and to meet the needs of petrochemistry and chemistry.

As is well known, the October 1980 CPSU Central Committee Plenum paid special attention to the role of bulk chemicals in developing agricultural and light industry and in speeding up technical progress. The map shows, aside from the named oil refining facilities, capacity for the output of ethylene and polyethylene (200,000 tons each per year) in the Kazan' association Orgsintez and of motor-vehicle tires at the Chimkent Rubber-Asbestos Combine.

New installations for ammonia (450,000 tons per year each) at the Fergana Nitrogenous Fertilizers Plant and the Pridon Chemical Plant in Voronezhskaya Oblast and for carbamide (990,000 tons of standard equivalent) at the Kemerovo association Azot will yield a meaningful addition to the production of "vitamins for the fields."

The turnover of large capacity for sulfuric-acid production is contemplated at the Yefremov Chemical Plant in Tul'skaya Oblast (500,000 tons per year) and the Almalyk Chemical Plant (450,000 tons per year) in Tashkentskaya Oblast.

Ferrous Metallurgy and Machinebuilding

Startup facilities for ferrous metallurgy are represented on the map with capacity for pouring half a million tons of steel and for cold rolling of the same amount of sheet at the Novolipetsk Metallurgical Plant and by a "2000" mill in Cherepovets.

Capacity for 2 million tons of iron ore each will go into operation at the Mikhaylovka Mining and Concentrating Combine in Kurskaya Oblast and at the Sheregeshskiy Pit Mine in Kemerovskaya Oblast. New coke batteries with a productivity of a million tons each per year will be turned over at the Magnitogorsk Metallurgical Combine and the Altay Byproduct Coke Plant.

The plan for 1981, as is evident from the map, calls for the startup of a number of large machinebuilding facilities--for the manufacture of steam turbines (Khar'kov), metal-cutting machine tools (Gor'kiy), forging and pressworking machines (Kuvandyk, Orenburgskaya Oblast), bearings (Lutsk), freight cars (Zhdanov and Kremenchug), electric motors (Vladimir and Poltava), oilfield, drilling and geological equipment (Kuybyshev and Baku), instruments for monitoring and regulating industrial processes (Ali-Bayramli of the Azerbaijan SSR), motor-vehicle engines (Zavolzh'ye, Gor'kovskaya Oblast), tractors and combines (Minsk), machines for livestock raising and mixed-feed production (Riga) and operating equipment for shopping and public eating enterprises (Dushanbe). The rebuilding and technical reequipping of many other machinebuilding enterprises is being actively pursued.

Consumer Goods

Production facilities for particleboard at the Verkhnyaya-Sinyachikha Plywood Combine in Sverdlovskaya Oblast, for wood fiberboard in the Estonian settlement of Pyussi, for furniture at the Irkutsk factory and Lithuania's Kauno-Baldai company, paper at the Kondopoga Pulp and Paper Combine, which will be introduced in 1981, are denoted by symbols for the lumber, wood-processing and pulp and paper industry.

The largest startup facilities for light industry are, for 1981, the cotton-spinning factory in Dolina, Ivano-Frankovskaya Oblast (87,700 spindles), the Tiraspol' Cotton Combine in Moldavia (1,054 looms), the Berdyansk Knitwear Factory in Zaporozhskaya Oblast (18.1 million linen knitwear articles per year) and the sewn-goods factory in the Turkmen settlement of Geok-Tepe.

Sixty thousand quintals of processed sugar beets per day--this is the capacity that is being introduced at the Zolotukhino Sugar Mill in Kurskaya Oblast. New departments for processing tomatoes will be put into operation in the Moldavian village of Speya. Large beer breweries will start to operate in Vladivostok and Simferopol', meat combines in Melitopol', Zaporozhskaya Oblast and Ternopol', and dairy enterprises in Kazan', Lipetsk and Ashkhabad. These facilities are an organic part of the country's agricultural-industry complex.

Agriculture and Procurement

State capital investment in the construction of agricultural production facilities and the development of industries directly connected with supplying agriculture with materials and equipment will be increased by almost 6 percent in 1981. Livestock-raising complexes for the rearing and fattening of young cattle (10,000 head each) in Tataria, Khabarovskiy Kray, Krymskaya and Donetskaya oblasts and Bashkiria and of hogs (108,000 head each) in Kuybyshevskaya and Gor'kovskaya oblasts, which are identified on the map, will be introduced.

High-capacity poultry factories that are oriented toward egg and meat production will be turned over for operation in Tataria, Georgia, Armenia, Chuvashia and Bashkiria and in Khar'kovskaya, Vladimirskaya, Irkutskaya, Leningrad, Kuybyshevskaya, Tul'skaya, Sverdlovskaya and Brestskaya oblasts.

Thirty-six hectares of covered space are called for at the Yuzhnyy hothouse combine in Stavropol'skiy Kray. In Krasnoyarskiy Kray 12 hectares of hothouses will be turned over. Six hectares each will be introduced at hothouse combines in Leningrad, Volgogradskaya and Vitebskaya oblasts and Krasnoyarskiy Kray.

Grain from the new harvest will be received by elevators in Saratovskaya, Sverdlovskaya, Ural'skaya and Tselinogradskaya oblasts and Bashkiria and by mills in Moscow and Chernigov. Among the procurement facilities shown on the map are mixed-feed enterprises in Leningrad Oblast, Abkhazia and Yuzhno-Sakhalinsk.

Transport Facilities

More funds (8.8 percent more) have been allocated than last year for developing rail transport. The Ust'-Kut-Kunerma line (281 km) on the Baykal-Amur Mainline and the Novosergiyevskaya (Pogromnoye)-Pugachevsk line (297 km) will be turned over for operation. The Orsk-Orenburg and Karaganda-Mointy sections are being electrified.

New mechanized piers are to be turned over at the Tallinn and Kaliningrad seaports and the Nizhnevartovsk river port.

⁂

Construction's production base is being strengthened. The map shows large capacity for the production of prefabricated reinforced-concrete structure and parts at building-materials enterprises, reinforced-concrete products plants and housing-construction combines in Liepaya (Latvia), Kalininabad (Tajikistan), Bezmein (Turkmenia), Murmansk, Nakhodka (Primorskiy Kray), Komsomol'sk-na-Amur, Magadan, Kaliningrad and Tallinn.

On entering the 11th Five-Year Plan period, Soviet builders are looking sharply at the promise opened up by the CPSU Central Committee's draft for the 26th party congress, and they recognize that the creation of a good backlog of started work for the succeeding period will depend greatly upon the results of their work in 1981. The realization of such huge programs as the buildup of the oil- and gas-bearing regions of West Siberia, the construction of the Baykal-Amur Mainline, the rehabilitation of Russia's Nechernozem'ye [nonchernozem zone] and the formation of large regional production complexes in the country's east will continue. The main reference point for the builders is the introduction on time or ahead of time of all the facilities that have been planned.

11409
CSO: 1821

CONSTRUCTION MACHINERY

UDC 621.879.44.064:624.139.55].001.76

IMPROVEMENT OF DIGGING ATTACHMENTS OF TRENCHERS FOR DIGGING FROZEN GROUND

Moscow STROITEL'NYYE I DOROZHNYYE MASHINY in Russian No 1, 1981 pp 8-9

[Article by Engineer B. V. Osipenko, L. K. Sokolov, candidate of engineering sciences, and Engineer A. V. Paneyev, Krasnoyarsk Affiliate of VNIIstroydormash (All-Union Scientific Research Institute of Construction and Road Machinery)]

[Text] Trenchers are among the basic types of machines capable of effectively digging frozen ground.

The Krasnoyarsk Affiliate of VNIIstroydormash, jointly with the Dmitrov Excavator Plant and the association Talleks, has for a number of years been working to improve existing trenchers and their digging attachments and create new designs of both for digging frozen ground. Research has been conducted under laboratory and field conditions in cutting both homogeneous frozen soil and also soil containing gravel and pebble inclusions.

On the basis of the results of the research that has been done a method was developed of determining the optimum parameters of the cutting elements and for selection of a stepped and staggered arrangement for location of their cutters as a function of the design of the digging attachment, the type of basic machine, and the solidity of the soil. This method has been used in designing and modernizing the digging attachments of trenchers developed by the affiliate.

In the 1968-1970 period the Krasnoyarsk Affiliate of VNIIstroydormash developed a new design of an externally driven digging chain (Figure 1) for the excavators manufactured by the association Talleks [1]. The ends of the connecting pins are extended beyond the links and have rollers attached to them that engage with the double sprockets. The cotter attachment of the shaft to the external link plates makes it possible to quickly disassemble the chain and replace a defective part. Experimental prototypes of the chain were tested on the ETTs-160 excavators in digging trenches in homogeneous soils, soils with inclusions of gravel and construction waste, and also in boggy areas at air temperatures from +25 to -32° C. It was found that the life of a new chain exceeds 2-3-fold the life of ordinary bush-roller chains.

The economic benefit from introducing the new chains is 2,500 rubles per machine per year.

Figure 1. Digging attachment based on the externally engaging chain of the ETTs-160 excavator.

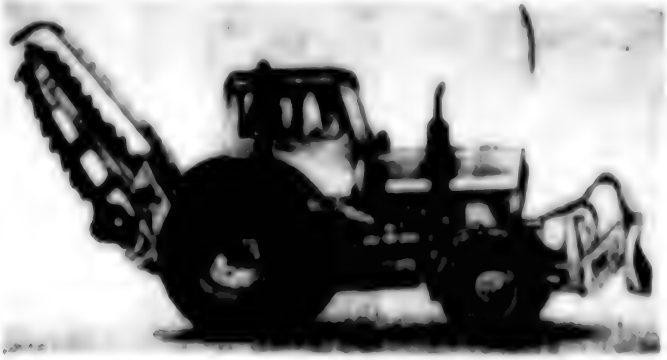

Figure 2. ETTs-165 excavator with modernized digging attachment.

In order to increase the operability of the ETTs-165 excavator in working frozen ground its digging attachment was modernized (Figure 2). Detachable blocks containing cutters 18 mm wide equipped with link plates of a hard alloy and push plates were installed at an interval of 100 mm on a series-produced chain. The two rollers on the frame of the digging attachment were given additional reinforcement. Special T-shape supports were introduced to reduce the sag of the chain and twisting of the carrier plates and cutters in the digging process. Installation of cutters twice as large as the average on the external cutting lines governed the pattern of location of the cutters in the digging attachment; their installation made it possible to distribute the loads among cutters and plates more uniformly.

Tests conducted in digging homogeneous loamy and sandy soils and also soils with gravel and pebble inclusions in areas of the city of Krasnoyarsk at air temperatures from -20 to 0° C and soil frozen to depths from 0.1 to 2 meters confirmed the operability of the modernized digging attachments. The excavator's output with the new digging attachment in digging frozen loam was from 51 to 116 meters per hour when the ground was frozen to a depth of 0.5 meter and the surface density ranged from 100 to 45 strokes on the DorNII densimeter. Output was 18-20 meters per hour when the ground was frozen to a depth of 2 meters.

The economic benefit of introducing the modernized digging attachment is 4,500 rubles per machine per year.

In the 1969-1971 period the Krasnoyarsk Affiliate began projects to apply hydraulic drive of the digging attachment in the design of trenchers. Tests of the TGM-2 trencher created by the Krasnoyarsk Affiliate of VNIIstroydormash showed that use of hydraulic drive of the digging attachment and running gear makes it possible to simplify the machine's design, to protect its assemblies reliably from breakage when the digging assembly encounters an obstacle it cannot overcome and to ensure automatic regulation of patterns of operation by simple means.

The results obtained were used in building an experimental prototype of the ETR-134 cutter-wheel trencher, which is mounted on a TT-4 skidder [2], which was done in the 1976-1978 period jointly with the Dmitrov Excavator Plant. The trencher digs trenches 0.28 meter wide and 1.3 meters deep in thawed Category I-IV soils and frozen ground with a hardness up to 200 strokes of the DorNII densimeter in the laying of cable lines or other utility installations. The trencher can also dig frozen ground by cutting solid blocks which are subsequently removed by other means.

The digging attachment of the ETR-134 trencher, which does not have buckets, consists of the solid wheel, the frame on which the wheel is mounted and the stripping shoe. The wheel consists of a stationary disk and a rotating disk. Blocks containing cutters are located along the perimeter of the rotating disk. The wheel is powered by a high-torque MR-1800 hydraulic motor, which is fed by a 210.32 pump.

The trencher's technical performance in digging thawed ground ranges from 150 to 300 meters per hour depending on the hardness and stickiness of the earth. In frozen ground with a surface hardness up to 200 strokes on the DorNII densimeter the trencher's output ranges from 20 to 50 meters per hour depending on the granulometric composition of the soil and the depth to which it is frozen.

The machine has good maneuverability and roadability. But we should note that the ETR-134 trencher does not have enough power to dig harder frozen ground. At the present time the affiliate is working to increase the output and operating reliability of the ETR-134 trencher, which is being produced on a series basis by the Dmitrov Excavator Plant.

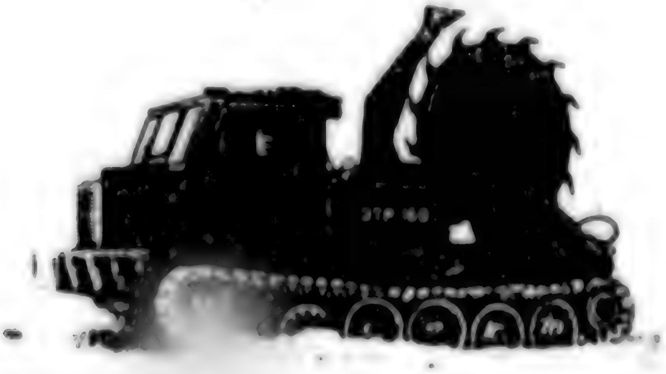

Figure 3. ETR-160 trencher with cutter wheel.

The economic benefit of introducing this trencher is 2,100 rubles per machine per year.

An experimental prototype of the ETR-160 trencher (Figure 3) has been developed and manufactured jointly with the Dmitrov Excavator Plant; a revolving support of the crane type was used in its digging attachment, so that with the same wheel diameter as the ETR-134 trencher, which is 2.3 meters, the depth of the trench the wheel can dig increases to 1.6 meters. At the same time the trencher is furnished with an extensible stripping shoe, which makes it possible to increase the digging depth to 2 meters in soft and muddy soils. The mechanism for raising and lowering the digging attachment of the ETR-160 excavator provides for forcing the digging attachment down and for increasing the trencher's stability when it is being transported thanks to the lower location of the center of gravity.

The stepwise and staggered pattern of arrangement of the cutters on the ETR-134 and ETR-160 trenchers (Figure 4) ensures smooth operation of the wheel thanks to uniform distribution of loads among cutters and blocks.

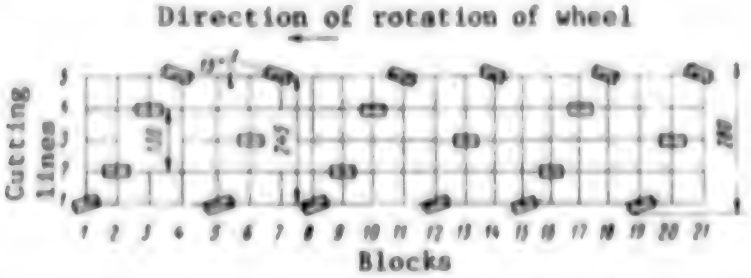

Figure 4. Pattern of cutter arrangement on the ETR-160 trencher.

The ETR-160 trencher is now going through tests in Krasnoyarsk.

The approximate economic benefit from introducing this trencher is 1,100 rubles per machine per year.

Recently the Krasnoyarsk Affiliate of VNIIstroydormash has begun efforts to create digging attachments capable of digging very hard frozen ground, which are to be mounted on heavy-duty tractors.

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CONSTRUCTION MACHINERY

UDC 625.7.084:629.11.012.55

SPECIAL TIRES FOR ROAD-ROLLING MACHINES

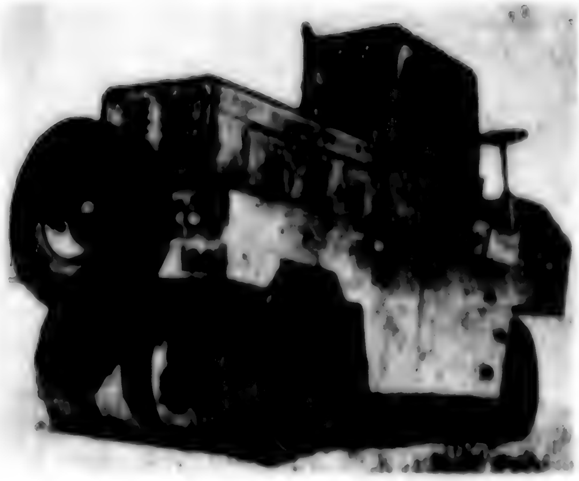
Moscow STROITEL'NYYE I DOROZHNYYE MASHINY in Russian No 2, 1981 pp 7-8

[Article by R. Ya. Saf'yanik and Zh. S. Kokorina, engineers, and A. G. Nechiporenko, candidate of engineering sciences, Scientific Research Institute for Oversized Tires]

[Text] Self-propelled rollers on air tires are used to roll earth, grit and gravel materials treated with organic and inorganic binding materials (asphalt, tar, cement) as well as hot and cold asphalt-concrete mixtures in building roads and airports. The specific nature of the work these rollers do requires that the pressure in the tires be regulated within the range from 0.3 to 0.8 MPa; at the same time constant width of the tire's contact with the roadbed or surface and uniform pressure over the area of the contact must be assured.

The tires used on the DU-29 and DU-31A rollers do not meet the necessary requirements with respect to the working assembly of the self-propelled rolling machines, with respect to the width of the impression, nor with respect to distribution of pressure over the area of contact. On the basis of the results of research to determine the optimum design of tires for rolling machines the Scientific Research Institute for Oversized Tires, on the basis of the technical requirements of VNIIstroydormash, has built the special tires 3x0-508 mod. F-55 and 370-508 mod. F-10A for self-propelled air-tire DU-31A (see the figure) and DU-29 rolling machines. These tires (Table 1), by contrast with tires of standard construction, have a smooth tread with a broader track and reduced curvature (Table 2), which has increased the width of the impression and the uniform distribution of pressure over the area of contact.

The results of laboratory tests have shown that the new tires meet the requirements of a rolling element of the rolling machine. For instance, when the pressure inside the tire is increased to 0.8 MPa and the load is the same on the wheel, the width of the tire's contact with the plane surface decreases only 2-3 mm, which is 0.6-1 percent of the width of the contact at a pressure of 0.3 MPa, whereas for the 370-508 mod. Ya-307 tire, this reduction of the width of contact is 23 mm, i.e., 8-9 percent. The variation of pressure over the area of the contact when the pressure in the tire is 0.6 MPa is within the limits of 0.1 MPA; this means that the distribution of pressure is close to uniform in the contact zone.



The DU-31A rolling machine on the 320-508 mod. F-55 special tires.

Performance and acceptance tests have shown that the tires meet the technical requirements, ensure high quality of compaction of road materials by reducing the number of passes of the rolling machine and thanks to greater uniformity of compaction from one side of the strip to the other, and they increase the machine's output 20-28 percent. Calculations show that the annual economic benefit from use of the 320-508 mod. F-55 special tires on the DU-31A rolling machine is 2,900 rubles and that of using the 370-508 mod. F-10A tires on the DU-29 roller is 2,500 rubles per machine.

The special tires have been recommended for series production on the basis of the results of acceptance and performance tests.

Table 1. Characteristics of the Special Tires for Rolling Machines

	Tire Designation	
Parameters	370-508 mod. F-10A	320-508 mod. F-55
Standard number of plys	20	16.0
Configuration of the cap tread	Smooth	
Outside diameter, mm	1,220 ± 10	1,110 ± 10
Width of the profile, mm	Up to 380	Up to 315
Static radius, mm	555 ± 5	525 ± 5
Designation of the rim profile	216V (8.5V)	216V (8.5V)
Maximum load on the tire when the tanks of the rolling machine are fully loaded with ballast, kN	43	23.6
Range of pressure regulation in the tire, MPa	0.4-0.8	0.3-0.8
Maximum speed, km/hr	20	20.0
Tire weight, kg	Up to 150	Up to 120

Table 2. Comparative Characteristics of the Parameters of the Track Made by the Tread of Tires Used on the Rolling Machines

Parameters	Tire Designation			
	370-508		320-508	
	Mod. F-10A	Mod. Ya-307	Mod. F-55	Mod. IYaV-12B
Configuration of the cap tread	Smooth	Greater roadability	Smooth	General purpose
Chordwise width of the track of the tread, mm	340	270	310	255
Thickness of the tread at the crown, mm	20	29	16	29
Cap tread camber, mm	13.7690	28.4980	19.465	20.0000
Ratio of the width of the track of the tread to the width of the tire profile as molded	1.0000	0.7950	1.145	0.9100
Ratio of the camber of the cap tread to the height of the tire profile as molded	0.0382	0.0778	0.034	0.0622

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METALWORKING EQUIPMENT

MACHINEBUILDING GREW RAPIDLY UNDER TENTH FIVE-YEAR PLAN

Moscow PRAVDA in Russian 28 Sep 80 p 1

[Interview with Deputy Chairman of the USSR Council of Ministers V. N. Novikov by PRAVDA correspondent A. Nikitin: "The Creators of Equipment"]

> [Text] Soviet machinebuilding today is made up of thousands of high-capacity plants and production associations and hundreds of scientific-research and industrial institutes and design bureaus. What problems are the equipment creators solving, and how are they carrying out the five-year plan? Deputy Chairman of the USSR Council of Ministers V. N. Novikov answers these questions by PRAVDA correspondent A. Nikitin.

"Machinebuilding has been developing at an overwhelming pace during the Tenth Five-Year Plan in comparison with industry as a whole, as was called for by 25th party congress decisions. The total amount of output during the first 4 years increased by almost a third. Growth of output of equipment for nuclear power stations, as well as for the production of motor vehicles, excavators, bulldozers, instruments and automation equipment, also rose. Output quality increased. More than 12,000 articles are now being produced with the honorary pentagon--almost twice as much as in 1975. An intense process of updating output is going on.

"A distinctive feature of modern machinebuilding is the priority given to growth in output of highly effective machines and assemblies of large unit capacity, automatic and semiautomatic equipment, and modern means of mechanization.

"Successes in machinebuilding are governed to a great extent by the status of the machine-tool making base. During the current five-year plan twice as many machine tools with numerical program control will be produced as were made during the Ninth Five-Year Plan. The production of machine tools with tool magazines (machining centers) has commenced. The share of forging and pressworking machines in the total output of metalworking equipment has increased.

"Our industry has undertaken the creation of automatic manipulators (robots) for various purposes. They play an important role in mechanizing and automating industrial processes, primarily in machinebuilding. Integrated automated sections, controlled by computers, that enable monotonous manual labor to be completely eliminated are being created, based upon industrial robots and equipment with program control.

"Since the start of the five-year plan the production of 266 units of new power-engineering equipment has been mastered. This is almost double that of the preceding five-year plan. The industry's advanced collectives met the goals for amounts of growth of standard net output and of labor productivity. They included collectives of the associations of the Leningrad Metal Plant, the Il'marine Plant, and other enterprises.

"Plant collectives of heavy and transport machinebuilding did much work to create modern highly productive converters and machines for continuous casting of billets. With their introduction, the structure of steelmaking has been changed.

"A drill rig created in the Uralmash association enables 16 wells up to 3 km deep to be drilled from one spot. This will cut the time for erecting equipment and will enable the number of brigades to be reduced. Oilfield workers plan to obtain the main portion of oil recovery in West Siberia by means of these rigs.

"In speaking of successes, one cannot be silent either about unsolved problems. These are: inadequate technical level and quality of various machines, their high metals intensiveness, and the slow introduction of new industrial processes, especially those that save materials and energy.

"The machinebuilders, who have been included in the competition for a proper greeting for the 26th party congress, are filled with resolve to complete successfully the plan for 1980 and the Tenth Five-Year Plan as a whole."

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METALWORKING EQUIPMENT

APPROACHES TO METAL ECONOMIZATION IN MACHINE BUILDING ANALYZED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 12, Dec 80 pp 10-18

[Article by N. Ryzhkov, First Deputy Chairman, USSR Gosplan: "Metals and Machines"]

[Text] Speaking at the November (1979) Plenum of the party Central Committee, CPSU Central Committee General Secretary, Chairman of the Presidium of the USSR Supreme Soviet L. I. Brezhnev emphasized that at the attained level of metal production, the main direction for further development of ferrous metallurgy lies not so much in its quantitative growth as in fundamental improvement of the quality of metal products and expansion of their assortment.

The growth in the amount of rolled metal produced in ferrous metallurgy during the last five-year plans was accompanied by continual growth in unit capital investments. This can be explained [illegible] some extent by the fact that sizeable capital investments are being allocated to mining industry, to environmental protection, to creation of output capacities for the production of high-strength and precision-rolled sections, and so on. But the sectors are still too slow in making the qualitative changes, and a lag in the introduction of new production processes can be observed.

We have not yet reached the five-year target for production of low-alloy steel, heat-strengthened rolled section and sheet metal and cold-rolled sheet steel. All of this requires a new approach to production of economical forms of rolled metal, and to its consumption primarily in machine building and construction, which are the principal metal consumers.

Discussing the certain lag in the development of metallurgy and machine building at the November (1979) CPSU Central Committee Plenum, L. I. Brezhnev dwelled specially on sensible use of metal. "Despite the tremendous scale of metal production, there is still not enough metal.... The metal content of much of the machines and equipment produced continues to be too high. The amount of waste in metalworking is not decreasing. Precision casting is being introduced too slowly."*

An extensive effort has been organized in the country under the guidance of party organizations to economize on material resources, metals primarily. The ministries, union republics, associations, and enterprises are making a concerted effort to standardize and reduce metal consumption in the production of machines and equipment.

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* Brezhnev, L. I., "Rech' na Plenume Tsentral'nogo Komiteta KPSS 27 noyabrya 1979 goda" [Speech to the CPSU Central Committee Plenum, 27 November 1979], Moscow, Politizdat, 1979, pp 13-14.

These issues have priority significance to the national economic plans. The "Basic Directions for Development of the USSR's National Economy in 1976-1980" foresaw a savings of rolled metal in machine building of around 14-16 percent. Planned measures presently being implemented in the national economy will make it possible to reduce rolled metal consumption per article in machine building by an average of about 15 percent in the 10th Five-Year Plan, which would be equivalent to saving 6.2 million tons of rolled ferrous metals. Nevertheless there are many shortcomings in metal consumption: Progressive metal-saving production processes are being introduced into machine building too slowly; the system for planning integrated metal consumption contains imperfections; improvements are required in the system of economic stimulation, accounting, and evaluation of metal production and consumption.

Machine building is a metal-intensive sector of the national economy. It consumes more than a third of the rolled metal produced, over 40 percent of the cast iron, two-thirds of the cast steel, and more than 60 percent of the forgings made from ingots, and stampings. Therefore effective use of metal products in machine building would make it possible to achieve a significant savings of metal in the country's national economy.

Computations made by the USSR Gosplan show that a savings in rolled ferrous metals in machine building can be achieved basically by improving production processes, raising the coefficient of metal use, improving the design and the weight characteristics of machines and equipment, using better-quality rolled metal and economical sections, and introducing ferrous metal substitutes. This will make it possible to attain higher indicators in metal economization within machine building sectors.

The level of economization that has been attained is not in keeping with the present progressive trends of material consumption in machine building. This can be explained mainly by the fact that production of structural plastics, aluminum, and other rolled ferrous metal substitutes is behind. The decrease in article metal content must be achieved mainly by using improved-quality rolled metals, and especially metal substitutes, and by making improvements in production processes and in the design and weight characteristics of machines and equipment.

The savings of metal we plan to achieve in machine building would be possible only if we make metal consumption more effective through integrated metal consumption planning. Because targets for average reductions of consumption norms are set for the machine building ministries only in relation to certain forms of metal products (rolled ferrous metals, and three types of steel tubing), a savings of certain metals is achieved at the expense of overconsumption of others (steel and pig iron castings, ingot forgings).

Beginning in 1981, in addition to setting targets for average reduction of the consumption norms for rolled ferrous metals, the USSR Gosplan will also set targets for general unit consumption of metals, to include castings, ingot forgings, and stampings, for reducing the metal content of certain types of the most important products, in natural terms, and for raising the coefficient of metal use.

One of the main reserves of metal economization is to reduce the metal content of the machines being produced.

Considering that the metal consumed in the manufacture of a machine is recovered only after the machine's life expires (after 30-40 years in some cases), and that creation of new steel and rolled metal production operations is requiring increasingly greater labor outlays and financial and capital investments, reduction of the metal content of machines is becoming one of the pressing problems of the national economy. The daily activities of plant and institute design collectives are aimed at solving it.

L. I. Brezhnev said the following at the October (1980) CPSU Central Committee Plenum: "For practical purposes it is through machines and production processes that science communicates with production and that progressive ideas influence production. Hence there is nothing to compare with the role played by machine building in the development of the national economy and in raising labor productivity."*

Designers and scientists are doing a great deal of work to raise the effectiveness of machines and equipment, to increase their unit capacity, and to decrease their proportionate metal content. The decrease enjoyed in the last few years in the proportionate metal content per unit of basic technical parameter was 20-30 percent for turbines and diesel locomotives, 16-20 for motor vehicles, 15 for diesel engines and diesel generators, 17 for tower cranes, 16 for chain-and-bucket excavators and mechanized complexes, and 15-17 percent for metallurgical machinery and machine units. The proportionate metal content of power production equipment corresponds to that of analogs being produced by technically progressive firms in capitalist countries. Certain models of domestically produced tractors and agricultural machines are also on par with the best foreign models in terms of proportionate metal content, and in a number of cases they surpass them.

Working together with designers of the Uralmash [Ural Heavy Machine Building Plant imeni Ordzhonikidze], the Novo-Kramatorsk, and other machine building plants, and with specialists of the leading metallurgical plants, scientists of the VNIImetmash [All-Union Scientific Research and Planning Design Institute of Metallurgical Machine Building] have achieved a significant decrease in the weight of many metallurgical machine units. Designers of the Uralmash have modernized their series-produced dragline--a walking excavator with a bucket capacity of 15 m^3 and a jib length of 90 meters. While keeping the jib length the same, the bucket capacity was increased to 20 m^3--that is, by 33 percent, the unit metal content of the machine decreased by 20 percent per unit productivity, and consumption of electric power per cubic meter of worked rock decreased by 5.5 percent.

These examples show that while external factors remain practically the same, the metal content of machines can be systematically reduced. However, an analysis conducted by the USSR Gosplan, the GKNT [State Committee for Science and Technology], and the USSR Academy of Sciences showed that a large number of the machines being produced by domestic industry are not satisfying these requirements.

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* PRAVDA, 22 October 1980.

One of the objective causes of the high metal content of equipment and mechanisms is the circumstance that machine designers are forced to use metal exhibiting low strength and operating characteristics, as a consequence of which the proportionate metal content of some types of machines and equipment in our country is higher than that of the best foreign models.

The higher material content of machine building products can be explained in many ways by the poor quality and assortment of metal products. Thus according to data of the USSR TsSU [State Statistical Administration] the proportions of top quality category products in the USSR Ministry of Ferrous Metallurgy are: 10.8 percent for solid rolled shapes, 4.9 percent for structural steel, and 14.2 percent for rolled low-alloy steel. In 1966-1977 the proportion of sheet steel in finished rolled metal production increased from 37.3 to 41 percent, while the same proportion is 65-69 percent for the USA and 62-65 percent for Japan.

The machine building sectors have not worked out a good system for monitoring the proportionate metal content of machines, and unification of parts and units is being utilized poorly as a means for reducing the metal content of machines (the level of unification is two to three times lower in the USSR than abroad). The principal scientific research, process engineering, and design organizations--the developers of new equipment--are displaying little responsibility in attaining optimum metal content for machines and equipment. The fight to reduce metal content has not become the principal factor of machine design.

This situation with the metal-intensiveness of some machines and equipment dictates the need for special requirements on the maximum permissible unit consumption of metal per unit of consumer impact of the product. The role of standardization is great in this connection, because the requirements on proportionate metal content of particular kinds of products, ones binding upon the creation of new models or modernization of existing models, must be reflected namely in the state or sector standards. The proportionate metal content indicator must be one of the principal ones considered when examining machine structure and when deciding whether or not to begin producing certain machines.

The USSR State Committee for Standards and the GKNT must develop a system of measures making it possible to set, in the near future and for all machine building ministries, concrete targets for reducing the proportionate metal content of the most important machines and equipment--targets insuring attainment of the level of the best domestic and foreign models; they must also organize effective control over this effort.

Beginning in 1981 the USSR Gosplan will be setting targets for reducing the metal content of the most important machine building products. The first effort at drawing up a plan for reducing the metal content of machines has demonstrated that there are great reserves in this area. Thus the targets for reducing the weight of some machines are from 3 to 26 percent for the Ministry of Power Machine Building, from 2 to 32 percent for the Ministry of Chemical and Petroleum Machine Building, from 2 to 21 percent for the Ministry of Machine Tool and Tool Building Ministry, and so on. Considering that the state plan cannot embrace the entire assortment of machine building articles, it would be suitable for the ministries to develop and approve sector targets for reduction of machine metal content, beginning in the next five-year plan.

Improvements in production processes raising the coefficient of metal use in machine building provide for about a third of the total metal savings. Decreases in metal weight and corresponding increases in the coefficient of metal use depend significantly on the progressiveness of billet structure and on the closeness of the shape of billets to the shape of the finished articles, and this goes a long way in defining the technical level of the billet production operations of the enterprises, and of the sector as a whole.

The consumption structure of the basic types of structural materials and billets in our country's machine building sectors is still insufficiently progressive. The proportion of rolled metal is 60 percent, while the share of steel and pig iron castings within the total ferrous metal consumption volume is about 1.5 times greater than in the USA. Progressive casting methods are employed in the following proportions in billet production: for smelted articles--0.6 percent of total production; using molds and hot-forged bars--6.4 percent; articles produced in metal molds (chill molds) and by the centrifugal method--16.7 percent.

The proportion of automatic lines and modern machines is too low in the pool of forging, pressing, and casting equipment. Thus the proportion of forging and pressing tools outfitted with automated and mechanized resources and with program control is about 3 percent of the total, while that of highly productive equipment is 10-11 percent. Growth in the effectiveness with which forging and pressing equipment is used is limited by the small scale of production, as a result of which the plants are forced to extensively employ obsolete equipment in free forging--23 percent.

One of the progressive production processes that raises the effectiveness with which rolled metal is used and reduces labor outlays in mechanical part working was developed by the VNIImetmash, involving the rolling of such parts in so-called part-rolling machines. The small machine tools created by the institute make it possible to prepare blanks with minimum tolerances for mechanical working with high productivity. These tools can produce blanks and parts with a diameter from 10 to 250 mm and a length from 50 to 400 mm, to include blanks for stepped shafts and axles, torsion bars, rail car axles, precision gear wheel and sprocket blanks for agricultural machines, bearing rings, and so on. Production of blanks and parts by this method raises labor productivity by 7-15 times, provides a metal savings of 15-30 percent, and increases the strength of parts and blanks by 30-50 percent.

Ninety-two part rolling tools that are now producing more than 1,250,000 tons of machine building blanks and parts annually have now been manufactured by the experimental plants of the VNIImetmash and by enterprises of the Ministry of Heavy Machine Building, and are now operating in machine building and metallurgical enterprises. The metal savings they provide is about 145,000 tons. Unfortunately this progressive direction in production technology has not enjoyed broad dissemination, probably due to bureaucratic barriers (machine builders are waiting for parts and blanks from the metallurgists, while the latter, in turn, believe their production to be the job of the machine builders).

The metallurgists are probably closest to the truth. We feel that the machine builders know their demand for such articles and can quickly plan and manufacture them, react to unavoidable changes in assortment promptly, and so on? Of course, this does not pertain to products such as mill balls, rail car axles, and so on.

It would be a good idea for the system of machine building plants to create, in addition to forging and pressing shops, sections and, possibly later on, shops rolling precision blanks for machine building parts. According to the actual demand for part rolling mills computed by the VNIImetmash, a minimum of 424 mills must be planned and installed, to include 58 at enterprises of the Ministry of Heavy Machine Building, 79 in the Ministry of Automotive Industry, 73 in the Ministry of Tractor and Agricultural Machine Building, 16 in the Ministry of Machine Tool and Tool Building Industry, and so on. These mills can produce more than 1.5 million tons of precision blanks and parts annually, which would mean saving about 350,000 tons of metal, freeing about 20,000 machine tools and 27,000 workers, and enjoying an economic impact totaling about 400 million rubles annually.

Considering the great economic impact enjoyed from introducing part rolling mills, in August of this year the USSR Gosplan examined proposals drawn up by the institute with the participation of the machine building ministries. It was decided to look into this issue more deeply, and to come up with concrete measures. The next five-year plan should see a turning point in this effort.

Production of parts from metal powder is an important direction in machine building technology. Powder metallurgy is capable of creating materials and articles with prescribed physical properties satisfying the growing requirements imposed on the technical level of machines and equipment. The processes involved in the production of articles from various powders, which involve the molding and subsequent baking of powders, excludes traditional processes such as smelting and casting, and they either exclude or minimize mechanical working.

Enterprises of the machine building ministries have accumulated a certain amount of experience in producing articles by the methods of powder metallurgy. However, the proportion of iron powder produced in total steel production is low.

The progressiveness of producing articles from powders has been confirmed by the effectiveness of this process. Just manufacturing 1,000 tons of articles intended for general purposes in machine building by the methods of powder metallurgy in place of traditional methods produces a savings totaling from 1.3 to 2 million rubles, and releases about 190 persons and 80 units of machine tools for other purposes. Use of iron powders in machine building and metallurgy makes it possible to save 2 tons of rolled metal for every ton of parts.

Scientific-technical developments in our country are making it possible to significantly expand the area of application of iron powders, and to organize their large-scale industrial production. The forecasts show that in the future, the weight of baked iron-based structural articles will increase to 20-25 kg/unit, dimensions will increase to 500-800 mm, and total production will attain 200,000-250,000 tons, to include 150,000-200,000 tons per year for articles made from iron and its alloys. The economic impact the country's national economy may enjoy as a result of such production will be 400-500 million rubles per year.

An extensive effort has been started to create new, progressive powders, and the output capacities for their production. The task of the machine builders is to develop this process to the fullest in the sector's enterprises.

One of the progressive directions of powder metallurgy is plasma spraying of various powders. The Institute of Electric Welding imeni Ye. O. Paton, the "Tulachermet" Scientific-Production Association, the All-Union Scientific Research Institute of Electric Welding Equipment, and others have done a great deal to develop the production processes and equipment for application of such coatings. All of this is making it possible to economize on scarce heat-resistant and non-ferrous metals, and to increase part life.

Implementation of an integrated program developed by the GKNT and the USSR Gosplan jointly with the ministries to create progressive powders will produce a significant savings of copper and its alloys, as well as of nickel alloys. This will require manufacture of more new plasma spraying units.

Plasma cutting, welding, and spraying and combined plasma-mechanical working are no less effective methods, and their introduction should be foreseen by the 11th Five-Year Plan.

Use of welded structures in place of cast and forged articles will not only produce a savings in metal during production, but it will also significantly reduce the metal content of the machines. By improving the known welding methods and developing new production processes, in recent decades the country has created specialized large-scale welding operations responsible for about half of the total billet production.

The continual growth in production of welded structures and the increase in their proportion within the total volume of billets produced (from 25 percent in 1960 to 50 percent in 1978) can be explained by their economic effectiveness, and by elimination, in the transition to the new production processes, of some negative phenomena associated with metallurgical conversions in machine building plants, and mainly in steel and pig iron casting shops. The work experience of the leading enterprises and the economic analyses of the machine building sector institutes demonstrate that a transition to billet welding results in a decrease of net part weight of up to 20 percent, and a decrease of billet weight of up to 30 percent, owing to which the amount of waste represented by metal chips decreases and the laboriousness of mechanical working drops. Statistics on the use of billets by enterprises of the Ministry of Heavy Machine Building indicate a decrease in waste represented by metal chips. The coefficient of billet use in the production of pig iron and steel castings is 0.86 and 0.83 respectively. It is 0.65 for forged pieces, 0.85 for stampings, and 0.95 for welded structures.

From a national economic point of view, we would need to consider the total coefficient for metal use. An analysis conducted by specialists of the Uralmash showed that with regard to the particular features of the production processes and the consumption coefficients associated with production of rolled metal and steel castings, and the coefficient of use of rolled metal in the production of welded structures, the consumption of liquid steel is 2 tons per ton of net casted part weight, and 1.6 tons per ton of net welded part weight.

The progressiveness of replacing traditional billets by welded structures is obvious to all machine builders. Nevertheless there are still great unutilized possibilities in this area, and recently the rate of replacement has decreased owing to the scarcity of rolled metal suffered by the national economic sectors, including machine building. A paradoxical situation is thus created: There is not enough rolled metal for welded structures, and this shortage is being created by a scarcity of pig iron and steel, which are being consumed in excessive quantities to produce traditional types of blanks.

Studies conducted by the USSR Gosplan, the Institute of Electric Welding imeni Ye. O. Paton, and the machine building ministries show that implementation of measures to replace uneconomical types of castings with welded structures would reduce the demand for pig iron and steel castings, especially at enterprises of the Ministry of Heavy Machine Building, the Ministry of Machine Tool and Tool Building Industry, and the Ministry of Construction, Road, and Municipal Machine Building. If enterprises are to be converted to the use of welded structures to the extent planned, we would need to allocate metal on the basis of specific needs, and establish clear control over its actual consumption, and over the efforts to reduce production of uneconomical types of blanks.

From the standpoint of metal economization, the progressiveness of production processes, mainly the preparatory operations in machine building, depends on the metal use coefficient. This indicator accounts for economic factors depending basically on the production enterprises themselves, placing less emphasis on external circumstances. In the last few years, the coefficient of use of rolled ferrous metals has remained practically unchanged, and in 1980 it was 0.735 for machine building and metal working as a whole. In some industries this index is below the average for machine building; in particular it is 0.695 in the Ministry of Chemical and Petroleum Machine Building, 0.68 in the Ministry of Automotive Industry, 0.674 in the Ministry of Electrical Equipment Industry, and 0.6 in the Ministry of Machine Tool and Tool Building Industry.

Because the use coefficient for metal is low, large quantities of wastes requiring further processing are formed. Thus according to the USSR TsSU, in 1979 the proportion of wastes in machine building as a whole in relation to ferrous metals (including steel and pig iron castings) was 26.6 percent--that is, out of every ton of ferrous metal consumed, 266 kg were lost as wastes, to include 6.8 million tons, or half of the wastes as chips.

The main causes of this situation are as follows:

systematic failure of enterprises of the USSR Ministry of Ferrous Metallurgy to supply rolled metals of the necessary dimensions and shapes, as a result of which a large quantity of metal is transformed into chips in the course of metal working, and into scrap metal in the course of cutting operations;

the low technical level of pattern cutting operations at machine building enterprises. Cutting tools working together with photocopying devices have not yet enjoyed broad application in the billet sections of welding shops. Domestic industry is producing limited amounts of cutting tools outfitted with ChPU [digital program control], while tools produced abroad have many computers capable of not only controlling metal cutting but also producing the most effective patterning of sheet metal with a maximum use coefficient;

slow progress in equipping metallurgical production operations at machine building enterprises, especially in regard to forging and pressing equipment;

absence of adequate attention to this issue on the part of enterprise and ministerial executives, and inadequate economic stimulation of metal economization in comparison with the preferential incentives for scrap metal.

The experience of the best enterprises shows that the machine building ministries have great reserves for raising the coefficient of use of rolled ferrous metals.

The low level of specialization and concentration in the production of billets intended for general uses in machine building is an obstacle to the use of new equipment and progressive production processes. Many billet shops at machine building plants possess little production equipment, there are few engineers on their staffs, and their technical-economic indicators are low. Centralized production of castings in the country does not exceed 4.5 percent of total casting production, and centralized production of forgings and stampings does not exceed 3 percent of the total. This does not promote low metal consumption and minimum mechanical working tolerances in billet production.

An integrated approach to introducing low-waste production processes must lie at the basis of all efforts of metal economization at the enterprises. Deserving of attention in this regard is the experience of the Moscow Motor Vehicle Plant imeni I. A. Likhachev (the "ZIL" Production Association) and other enterprises that have introduced low-waste production processes in the manufacture of precision billets and finished articles.

If we are to achieve the level of metal economization foreseen for machine building, it would be important to expand production of billets primarily with wasteless and low-waste methods. For these purposes we would have to raise the proportion of precision stampings within the total production volume of hot stampings by not less than 30 percent; precision castings manufactured on the basis of progressive production processes, within the total casting volume, to 49 percent; parts produced by compression molding, to include production of cast aluminum, from 32 to 44 percent; billets obtained by electroslag casting, to 95,000 tons. Moreover we would need to increase the proportion of forging and pressing equipment within the total pool of metalworking equipment to 20 percent, in which case the proportion of automatic forging and pressing tools and of automated complexes and machines should exceed three-fourths of their total production.

One important means for reducing the demand for metal in machine building is to use rolled metal of better quality and more economical shape. Use of high quality structural materials of the needed assortment and dimensions would promote not only a decrease in production wastes but also a drop in the proportionate metal content of machines and an increase in their technical level, productivity, life, and reliability.

One of the criteria used in assessing the work of ferrous metallurgy is production of economical forms of metal products. Unfortunately the machine building sectors are systematically undersupplied with high quality steel. In 4 years of the present five-year plan, machine building received about 4 million tons of rolled metal less than required by the annual plans; this pertains mainly to items crucial to attainment of the 10th Five-Year Plan's targets of metal economization. As a result the machine builders are undersupplied a significant quantity of low-alloy rolled metal, cold-rolled sheet steel, and sheet steel supplied in rolls.

Computations show that if we are to reduce the metal consumption norms in machine building by 18-20 percent in relation to the amount presently consumed, we would need to achieve the following production increases: by 2 times for rolled and low-alloy steel, by 2.7 times for heat-strengthened rolled metal, by 1.9 times for cold-rolled sheet metal, by 2.2 times for bent sections, by 3.2 times for dynamic cold-rolled steel, by 1.5 times for rolled alloy steel, and by 2 times for high-precision shaped sections.

A proposal by the Institute of Electric Welding imeni Ye. O. Paton to produce and use rolled metal with differentiated strength properties in machine building deserves attention. Use of such steel would produce a high economic impact, but it would require a certain amount of changes in the rolling processes of the metallurgical plants, in the design documents, and in the organization of production at machine building enterprises. The machine building ministry must do a great deal of work to create the technical documents in support of broader use and higher proportion of sheet metal and other progressive forms of rolled metal.

Introduction of ferrous metal substitutes is one of the most promising directions of metal economization. Unfortunately the absolute value of its effectiveness is low, not exceeding 1 percent of the total savings.

Plastics should be thought of as the principal substitute of ferrous metals in machine building. Presently machine building consumes 750,000-800,000 tons of synthetic resins and plastics annually, to include about 250,000 tons consumed in electrical equipment industry (this includes 150,000 tons in cable industry). The economically feasible volume of polymer consumption could be 1.5 times greater right now. In automotive industry, a ton of polymers replaces 3-4 tons of rolled metal, reduces the labor requirement in article manufacture to 500 man-hours, and produces an economic impact of about 1,000 rubles.

Agricultural machine building has great possibilities for using polymers and saving metals as a result. By using plastics in the production of the cabs, hoods, housings, and other parts of agricultural machines, we could significantly reduce their metal content.

We have now obtained polymers with properties superior to those of other structural materials. The unit strength and rigidity of organic fibers is 20 times greater than of the best steel.

Considering the high effectiveness of using plastics in machine building, we must increase their production in the near future. This issue must be reflected in the five-year plan presently being developed.

Another great reserve of economization is substitution of ferrous metal by aluminum. Estimates show that just in automotive industry alone, the use of aluminum alloys could be increased by three to four times. The proportion of castings made from nonferrous metals and their alloys is too low.

Sensible use of ferrous metals is a multifaceted issue. We have limited ourselves here to just the main direction of their economization in machine building. Economization of rolled metal in the course of its production, and in construction is no less important. The party and government have determined the paths of all-out economization of metal products. The task of the business organs is to implement them.

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METALWORKING EQUIPMENT

PATHS TO METAL ECONOMIZATION IN MACHINE BUILDING ANALYZED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 1, Jan 81 pp 45-51

[Article by USSR Academy of Sciences Academician A. Tselikov, General Director, VNIImetmash Scientific-Production Association; P. Malinovskiy, Division Director, VNIImetmash; and N. Golubenko, Laboratory Director, VNIImetmash]

[Text] Reducing the material-intensiveness of social production plays a highly important role in raising its effectiveness. In its decree "On the Work of the Ministries of Metallurgy, Machine Building, and Construction to Raise the Quality of Metal Products and Achieve Effective Use of Metal on the Basis of the Introduction of Low-Waste Technology in Light of the Requirements of the November (1979) CPSU Central Committee Plenum", the CPSU Central Committee notes that raising the effectiveness of production and the use of metal in industry and construction is a task of priority state importance. There is special significance to reducing materials-intensiveness in machine building, since this sector consumes about 40 percent of all ferrous metals, as well as a significant proportion of expensive and scarce materials. Metal being the principal structural material in the production of machine building products, makes up about 99 percent of the total material consumption structure of machine building.

Certain successes were achieved in recent years in replacing metals by new synthetic nonmetallic materials. They include various polymers, fiber glass, synthetic diamonds, and cubic boron nitride (borazon). Deserving of special attention are composition polyamides and fiber glass, the unit strength of which is not any lower than that of the best grades of steel, and the corrosion resistance of which is higher in some environments than that of the best corrosion-resistant metals. The technology of nonmetallic materials will doubtlessly improve in the future, and their quality will rise.

However, the efforts to replace metals with new materials in machine building are complicated by the fact that almost all known metals--there are about 70 of them--possess special physical and chemical properties inherent to just the given metal alone. These properties are necessary to modern technology, and therefore substitution of such metals by other materials is impossible in many cases. As an example beryllium, lithium, and magnesium alloys have the highest unit strength per unit mass, and their substitution by boron or carbon fibers is not always possible. Transformer, electric generator, and other electrical engineering alloys with special magnetic properties contributed by iron could hardly be replaced by articles made with nonmetallic materials. Zinc is a general-purpose metal used in power supplies. Copper and silver are the best conductors of electricity and heat. Tungsten, molybdenum, and titanium will continue to be significant for a long time as high melting point metals and as alloying elements in many grades of steel.

The rise in speeds of which aircraft are capable is making it necessary to create alloys exhibiting higher heat resistance--niobium, tantalum, zirconium, and others. Production of superconducting alloys, particularly niobium alloyed with tin and titanium, will be organized soon.

Successes in development of new nonmetallic materials should somewhat reduce the rate of production of some metals, but in general, metals will retain their significance for 15-20 years as the principal materials of machine building and of most other metal consuming sectors of the national economy.

The draft "Basic Directions of the USSR's Economic and Social Development in 1981-1985 and in the Period to 1990" foresee an average decrease of not less than 18-20 percent in unit consumption of rolled ferrous metals in machine building and metalworking. In this connection the task of reducing the materials-intensiveness of machine building must primarily entail economization of metals and improvement of the materials employed and the processes used to manufacture them. Reduction of the materials-intensiveness of machine building products will not only reflect itself as a decrease in product cost, but it will also free significant amounts of metal for the national economy, and reduce the expenditure of fuel, energy, and other material resources. More compact machines and equipment require less production space, and smaller transportation outlays and capital investments, thus producing a significant savings of materials and assets in the machine using sectors.

Today, many machine building products are typified by excessive metals-intensiveness, in both production and design. The weight of many machines produced in the USSR, for example motor vehicles, tractors, agricultural machines, bridge cranes, excavators, and so on, is greater than that of similar foreign machines. Moreover metal wastes are still sizeable in machine building and metalworking. The coefficient of metal use is about 0.79, and it has hardly changed over a number of years.

Metal wastes reach about 20 million tons per year, to include about 9 million tons in chips. Because of the high use coefficient of metal, 3-4 million tons of chips are produced per year. Because about 20 percent of the metal is irreversibly lost when chips are resmelted, the losses due to this quantity reach 1 million tons per year.

Metal use in machine building is not effective enough because of imperfections in the structure and narrowness of the assortment of materials used in machine building, especially rolled ferrous metals; another reason is the low proportion of progressive production processes in machine building.

The shortage of progressive types of rolled metals forces designers planning machines and equipment to use materials with lower strength and operational characteristics. As an example sheet metal, especially cold-rolled metal, is known to be the most economical form of finished rolled metal. Use of such sheet metal in place of hot-rolled metal in machine building produces a metal savings of about 30 percent; however, not enough of this is being produced.

Use of continuous-cast steel or products made from it in machine building reduces metal consumption by up to 15 percent, but not enough is being produced. The proportion of steel cast in continuous-casting units was 10.6 percent in our country in 1979, while in foreign developed countries it was 40 percent.

Owing to significant improvement of its mechanical properties in comparison with unevacuated steel, evacuated steel reduces metal consumption by 10-15 percent. However, evacuated steel production is poorly developed, and its annual output is only about 0.6 percent.

The existing assortment of solid rolled shapes does not satisfy the demands of modern machine building. Many machine parts could be manufactured out of precision shapes without further working, requiring only cutting to the required length, but instead, we are forced to work solid rolled shapes on machine tools, which means considerable losses of metal as chips. As an example production of elevator guides, the demand for which is growing in our country due to construction of high-rise buildings, was organized by the VNIImetmash [All-Union Scientific Research and Planning Design Institute of Metallurgical Machine Building] at the Omutninsk Metallurgical Plant. Elevator guides are produced at this plant by a drawing process, rather than mechanical working out of rolled metal. A savings of more than 5,000 tons of metal per year has been achieved at this plant just due to this alone.

The annual demand for I-beams in the USSR exceeds 2 million tons. Their substitution by wide-flanged beams would reduce metal consumption by more than 140,000 tons per year. Thus further assimilation of a general-purpose girder mill created by the Uralmash [Ural Heavy Machine Building Plant imeni Ordzhonikidze] at the Metallurgical Combine in Nizhniy Tagil' has great significance. But this mill is unable to satisfy the demand for broad-flanged girders. Today there is an extremely great need for smaller and medium-sized girders with a height less than 400 mm and a flange breadth less than 200-250 mm, and for thin-walled girders, which cannot be obtained by rolling. Such girders are required in many metallic structures, for example in freight handling machines. In order to solve this problem the Institute of Electric Welding imeni Ye. O. Paton and the VNIImetmash conducted a program of scientific research and design projects that led to the decision to build a mill to produce thin-walled I-beams by radio-frequency welding out of three elements. The productivity of such a mill would be 350,000 tons per year, and the metal savings would be 120,000 tons per year. However, despite the indisputable advantages of using such a mill, its construction is being postponed.

An especially great metal savings resulting from enlargement of the assortment of rolled shapes could be achieved in the production of small series and single items of machine building products. Such operations require a broad assortment of sections, and they are far from completely satisfied. Each year, excessive consumption of rolled ferrous metals due to rejection of consumer orders exceeds 1.5 percent of the demand in machine building and metalworking.

Expansion of the use of aluminum is a great reserve for metal economization in machine building. Preferential production and consumption of aluminum and rolled aluminum has become the dominant trend in world technical development. In terms of the quantity of metals contained in the earth's crust, aluminum holds first place (about 8.8 percent) and iron holds second (about 4.65 percent). Thus aluminum is recognized to be a promising metal. It has a number of advantages over iron: low specific weight (three times lower than iron), high corrosion resistance, relatively high electrical conductivity, good ornamental qualitites, and production advantages making it possible to use it as a substitute for steel and heavy nonferrous metals in many cases. Moreover the durability and impact strength of aluminum and its alloys do not decrease in response to a temperature decrease, as is the case with steel. This property of aluminum alloys opens the road for their broader use in machines and in various structures used in the country's northern regions.

The only thing holding use of aluminum back in comparison with steel is the considerable outlays on its extraction from ore, which requires electrolysis of hot alumina solution. Each ton of extracted metallic melted aluminum requires consumption of 14,000-18,000 kw·hr of energy--that is, about 30 times more than required in the smelting of steel in arc furnaces. As a result, its cost per unit volume is three to four times greater than that of steel. But owing to the advantages indicated above, in many cases use of aluminum is more effective in comparison with ferrous metals. As the experience of foreign countries and research conducted in the USSR show, the most effective area of use of aluminum alloys is transportation machine building, especially rail car, crane, and motor vehicle construction.

Rolled steel is the most economical raw material in machine building and in many other sectors of the national economy. It possesses the highest unit strength, per cost of unit volume. Use of welded structures made from rolled metal in the place of castings, for example, reduces the weight of articles by 20-50 percent. But rolled steel is not being produced in the required quantity, inasmuch as many rolling mills are not operating at full productivity due to the absence of the castings and billets they need.

Thus mill idleness due to absence of billets was 1.5 percent of nominal time in 1979, which is equivalent to a loss of about 2 million tons of finished rolled metal. Moreover there is not enough of the initial metal, because consumption norms are limited for machine building enterprises only in relation to rolled metal, and not all forms of ferrous metals. Therefore rather than rolled metal, the enterprises are forced to use castings, the metal content of which is an average of 20-30 percent higher, and the production of which is more capital-intensive than rolled metal. As a result the metal content of machines and the capital outlays grow, and development of machine building is retarded due to the chronic shortage of rolled steel.

In order to supply enough metal to machine building and raise its technical level, we need to convert from the practice of planning economization of rolled ferrous metals alone to planning economization of ferrous metals in general.

Reduction of structural and unit metal content is a significant reserve of metal economization in the creation of machines and machine units. Reducing the unit metal content of machines and their absolute weight is the most effective way to economize on metal, since metal wastes in machine manufacture taking the form of scrap may be reused, while pure metal contained within a machine is recycled only upon expiration of the machine's life, and not always completely, owing to corrosion, wear, and other losses.

In order to reduce the structural metal content of machines, designers are seeking new concepts, they are employing sensible power train schemes and articulations, as well as hydraulic and pneumatic drives, they are foreseeing the strengthening of parts by thermal and mechanical working, and so on.

As an example rather than large power plant stands, the presses designed by the VNIImetmash for diamond synthesis employ lighter stands wound with high-strength metal bands; the strength of such stands is greater than that which can be achieved with the massive amounts of metal from which such stands are usually manufactured. As a result a press with a force of 2,000 tons weighs 8 tons, as opposed to the 30 tons of the usual design. Prestressed stands designed by the VNIImetmash are of significantly lower weight than stands of traditional design.

Increasing the strength of teeth on gear wheels is a highly promising way of decreasing the weight of reduction gears, since this makes it possible to reduce the width of the wheels, their intercenter spacing, and so on. Research established that the weight of a reduction gear is approximately inversely proportional to the cube of tooth hardness. A significant proportion of domestically produced reduction gears have teeth exhibiting hardness 20-25 percent lower than that of the best foreign models, as a result of which the weight of reduction gears must be increased by 70 percent. The USSR produces 350,000 tons of reduction gears per year. A decrease in their weight averaging 30 percent would result in a metal savings of 100,000 tons per year.

A modern method for producing gear wheels proposed by the VNIImetmash is to roll the rims of the gear wheels and then to mill the teeth. This method for producing gear wheels is being used only at the Chelyabinsk Tractor Plant. It is not being introduced at the Plant imeni Lenin. The strength of gear wheels obtained by this method is an average of 20 percent higher than that of wheels manufactured by foreign firms. Thus the method proposed by the VNIImetmash for producing gear wheels will make it possible to manufacture reduction gears that are significantly lighter than foreign models.

Preferential increases in machine productivity or output capacity, and of dependability and reliability, in comparison with machine weight, is a most important means for reducing unit metal content. Use of machines exhibiting higher output and productivity reduces the national economy's demand for machine building products, thus creating a significant metal savings as a result of the decrease in the unit metal content of machines and machine units.

Thus a steifel tube rolling mill with a productivity of 100,000 tons per year weighs 4,000 tons--that is, unit metals-intensiveness per ton of annual tube production would be 0.04 tons, while the unit metals-intensiveness of the "30-102" mill at the Pervoural'sk Tube-Rolling Plant, which has a productivity of about 600,000 tons and a weight of 11,000 tons, would be twice lower--that is, 0.02 tons per ton, despite the greater weight of the mill itself. Use of such a machine unit reduces the national economy's demand for equipment, thus insuring a savings of 11,000 tons of metal.

Use of electric power plants with three single-shaft steam turbines with an output capacity of 800,000 kw each instead of eight with an output capacity of 300,000 kw each would produce a savings of 3,500 tons of metal.

As was noted earlier, many domestically produced machines have lower working speeds, productivity, reliability, and life than their world analogs, which is why their unit metal content is higher. The reason for this lies in the fact that the machines are not subjected to renovation over long periods of time (up to 15 years), and many types of them have become obsolete. Despite the fact that about 1,500 brands of obsolete machines, equipment, and instruments are retired from production each year, the rate of renovation of machine building products cannot be deemed satisfactory, since the proportion of commercial products manufactured by enterprises of 11 machine building ministries has not decreased in more than 10 years, exceeding 27 percent in 1978.

Inasmuch as machines and equipment become obsolete 8-10 years after they are placed into production as a rule, there is a need for hastening renovation of machine building products. With this purpose we would need to place more emphasis on reexamining the machines, especially those in series production, with an eye on more up-to-date design concepts and progressive production processes and materials, such that in 1981-1985 we could improve the structure of machine building products and switch labor and material resources to the manufacture of more-productive and less metals-intensive equipment for the national economy.

Extensive use of part-rolling mills developed by the VNIImetmash and employing wasteless production processes is a great reserve of metal economization in machine building, and a means for raising the metal use coefficient. These mills are intended to manufacture economical blanks for various shafts, axles, gear wheels, wheels, bushings, drills, and other machine parts. Because the rolled blanks differ so little from the finished parts, production wastes are down to 2-3 percent, as opposed to the traditional 27-28 percent, and the metal savings attains 15-30 percent of the weight of the initial blanks. Thus production of rail car axles by the rolling method was assimilated at the "250" mill of the Dneprovsk Metallurgical Plant imeni Dzerzhinskiy, resulting in a savings of over 20,000 tons of metal per year.

Introduction of modern mills can produce a metal savings in the national economy totaling about 500,000 tons per year, owing to a conversion from the forging and machining of many parts to rolling. Concurrently, use of rolled metal raises the strength of parts--by 25 percent for gear wheels as an example--and it increases labor productivity by many times. The time has come to consider the question of organizing series production of such mills.

The VNIImetmash has also developed an effective method for producing variable cross-section hollow-core shafts which, while retaining their strength characteristics, are significantly lower in weight. Development of the production of hollow shafts (mainly with a diameter greater than 70 mm), for example for transportation, is an extremely promising means for reducing metal content.

The weight of cast parts (except for those manufactured by precision casting) is 3[illegible]-50 percent greater than the weight of stamped and welded parts, due to over-consumption of metal. As an example according to data of the Novo-Kramatorsk Machine Building Plant imeni V. I. Lenin, cast reduction gear housings are an average of 28 percent heavier than housings welded out of rolled metal. According to data of the Elektrostal' Heavy Machine Building Plant, castings are 35-40 percent heavier than welded structures.

In this connection the proportion of cast parts in machine building is significantly higher in the USSR than abroad. In a number of sectors, castings make up 50-60 percent of the total weight of machines; for example in metallurgical machine building the figure is 55 percent (while in the USA it is 25-35 percent). The proportion of casting production within total finished rolled metal production in the USSR is 25 percent, while for a number of foreign economically developed countries it does not exceed 18-20 percent. This is why the USSR produces 6-7 million tons worth of castings per year more than in the USA. It should be noted concurrently that use of castings in place of welded structures raises the labor-intensiveness of parts made from such castings by 2.0-2.3 times, and increases the total capital investments on production of parts out of castings by 40-60 percent in comparison with similar welded parts.

Broader use of rolled metal in machine building in place of castings produces a significant metal savings. Replacement of 6-7 million tons of castings by welded structures made from rolled metal would reduce their weight by 30 percent and produce a savings of more than 2 million tons of metal per year.

Moreover the irreversible losses of metal in the resmelting of wastes formed in the course of blank working are significantly reduced. The reason for this is that about 90 percent of the wastes resulting from mechanical processing of castings consist of chips, and chips created in the processing of welded blanks made from rolled metal make up only 40 percent of the wastes. Thus the proportion of chips in the wastes created by heavy and transportation machine building in the processing of parts made from castings is 88-95 percent, while the same proportion in relation to parts made from rolled metal is 42 percent. Because about 20 percent of the metal is lost irreversibly as oxidation wastes during resmelting of chips, replacement of this quantity of castings by welded blanks would reduce metal losses by more than 200,000 tons per year, even with the existing coefficient of metal use (0.79).

Another cause of considerable metal overconsumption is the preferred use of cupolas rather than induction furnaces for pig iron smelting. The volume of iron castings made for machine building in the USSR is about 8 million tons per year. Over 90 percent of these castings are smelted in cupolas. Smelting in cupolas is characterized not only by low casting quality in comparison with metals obtained in induction furnaces (the weight of the castings is 25 percent higher on the average) and greater coke consumption, but also significant loss of metal as oxidation wastes--an average of about 10 percent.

The proportion of iron castings obtained in induction furnaces in the USSR is 6-8 percent, while in world practice it attains 30-70 percent. Were we to increase it to at least 30 percent--that is, by about 3-4 million tons, we could achieve a metal savings of around 1-1.5 million tons per year just due to the reduction in oxidation losses and improvement of casting quality.

Tungsten and molybdenum--the scarcest high melting point metals--are most broadly employed today in steel intended for the manufacture of machine tools. The concentration of these metals in the earth's crust is extremely insignificant: tungsten--0.0001 percent, molybdenum--0.00011 percent.

For a long period of time, steel containing about 18 percent tungsten was thought to be the best high-speed steel and one of the most widespread sorts. In the last 10-15 years manufacturers have started replacing it with steel with a tungsten content close to that of brand R6M5 steel (containing 6 percent tungsten), in which 12 percent of the steel is substituted by 5 percent molybdenum. However, this substitution has not solved the problem of economizing on high melting point metals, inasmuch as molybdenum is also a scarce metal, and its cost is still higher than that of tungsten.

Today, the majority of machine tools are being manufactured out of high-speed tool steel. The principal way to economize on tungsten and molybdenum should be sought in development of high-speed steel containing these alloying elements in smaller quantities. Tools made from such materials can include, for example, cutters with removable high melting point cutting elements made from titanium compounds, or manufactured out of tungstenless steel subjected to carbonization. The wear resistance of such tools is two to three times higher; moreover consumption of tungsten-containing materials is reduced by 50 percent. However, only 15-20 percent of the demand for such tools is being satisfied.

Another direction of tungsten economization is broad use of special methods for rolling out machining tools, developed by the VNIImetmash. As an example the rolling of drills that have found extensive applications in a number of tool plants has produced a savings of up to 35 percent high-speed steel, due to exclusion of wastes taking the form of chips.

We have enumerated a number of the principal directions for solving the most important problems of metal economization in machine building. Efforts in these directions in 1981-1985 will promote fulfillment of the task, posed by the party and government, of reducing the materials-intensiveness of social production in the immediate future.

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METALWORKING EQUIPMENT

MACHINE BUILDING INNOVATIONS WILL RAISE QUALITY, PRODUCTIVITY

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 1, Jan 81 pp 52-58

[Article by L. Snovskiy, V. Lebedev, and S. Kuznetsov: "A New Stage in the Development of Machine Tool Building"]

[Text] Much attention is devoted in our country to development of machine tool building industry; each year this sector produces about 300,000 machine tools, and forging-pressing and casting machines. The products of machine building play a significant role in raising the technical level of material production, and particularly in reequipment of highly important national economic sectors such as machine building and metalworking. "Accelerated provision of modern, progressive equipment to all sectors of the national economy," noted L. I. Brezhnev in his letter to the collective of the Moscow Krasnyy Proletariy Machine Tool Building Plant imeni A. I. Yefremov, "is the most important lever insuring significant growth in the effectiveness of social production...."[*]

That development of machine tool building industry is intensive is evidenced by the fact that in 1980, in comparison to 1975, the volume of machine tools produced will increase by not less than 1.5 times, production of automatic machine tool lines will increase by 1.1 times, production of machine tools equipped with digital program control will increase by 1.66 times, production of forging-pressing machines will increase by 1.53 times, production of casting equipment will increase by 1.7 times, and production of metalworking tools will increase by 1.27 times.

Technical progress in machine building depends to a significant extent on the qualitative structure of the machine tool pool. Being the technical base of the machine building and metalworking sectors, the machine tool pool predetermines the basic directions in the development of machine building production.

"The universally recognized contribution of machine tool and tool building industry to accelerating scientific-technical progress," noted A. P. Kirilenko, "included achievements such as creation of the world's first automatic plant manufacturing motor vehicle pistons, an automatic shop producing bearings, machine tools with digital program control, assimilation of the series production of high-precision machine tools for instrument making, and of unique equipment for heavy and power machine building, and organization of the mass production of synthetic diamond tools."*

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[*] Brezhnev, L. I., "Leninskim kursom" [Following Lenin's Course], Vol 6, Moscow, Politizdat, 1978, p 282.

In recent years the structure of the machine tool pool, mainly in the machine building and metalworking sectors, underwent improvement resulting from an increase in the production of more productive and more precise machine tools, forging-pressing machines, and casting equipment, construction of new machine tool building enterprises and expansion of existing ones, and reequipment of such enterprises, which produced positive results.

However, the production structure and the technical level of the machine tools, forging-pressing machines, and casting equipment presently being produced today do not fully satisfy the growing requirements of the machine building and metalworking sectors. Production of a number of needed types of machine tools, forging-pressing machines, and casting equipment has not been organized yet. As an example we are not producing multiple-cylinder circular grinders intended for finishing crankshafts and camshafts for internal combustion engines, some types of machine tools working piston rings, forging-pressing machines, to include multistation sheet-stamping presses with a force of more than 1,000 tons, mechanical and hydraulic presses for cold pressing with a force of 1,000 tons and more, and clean-cutting presses, owing to which such equipment is being imported in significant quantities.

Certain types of machine tools, forging-pressing machines, and casting equipment are inferior to similar world models in their technical-economic indicators.

As a rule, machine tools now being produced are not being delivered as entire packages; full outfits of equipment, together with the necessary automation resources insuring continuity and completeness of the part working process, including machines for small-series and series production, are hardly ever manufactured and supplied to users.

Measures are presently being implemented in the machine building and metalworking sectors to improve production processes and organize production on the basis of the use and extensive introduction of highly productive metalworking equipment, but the status of these projects is still not fully in keeping with today's requirements.

If the production rate of machine building and metalworking products is to grow preferentially (without increasing the number of production workers, and mainly machine tool operators), we would need to implement measures to improve production processes employing highly automated and mechanized metal working equipment, not only in large-series and mass production, but also in series production by the machine building sectors.

These and other tasks associated with assimilating and producing new, modern equipment are spelled out in the CPSU Central Committee and USSR Council of Ministers decree "On Significantly Raising the Technical Level and Competitiveness of Metalworking, Casting, and Woodworking Equipment and Tools". According to it, in the 11th Five-Year Plan the Ministry of Machine Tool and Tool Building Industry is obligated to initiate extensive introduction of progressive production processes and highly effective production organization methods into machine building. Creative collectives of machine tool building industry are to design about 400 fundamentally new types of machine tools and forging-pressing and casting machines.

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*PRAVDA, 12 March 1980.

The CPSU Central Committee's draft report to the party congress, "Basic Directions of the USSR's Economic and Social Development in 1981-1985 and in the Period to 1990", notes that machine tool building and tool industry will have to insure the following in the next five-year plan:

accelerated development of the production of complexes of metalworking equipment outfitted with automatic manipulators;

significant enlargement of the production of: metalworking tools equipped with digital program control, especially multiple-operation systems in which tools are changed automatically, automatic lines for machine building and metalworking, including adjustable lines; heavy and unique machine tools and forging-pressing machines; equipment automating the assembly of mass-produced articles;

expansion of the production of outfits of automatic woodworking equipment for the manufacture of furniture, wood chip panels, carpentry articles, wooden panel houses, and other wooden articles;

increase manufacture of tools, including abrasive tools, so as to insure fuller satisfaction of the demand for them by machine building, metalworking, and other sectors.

There are plans for raising, by 1986 in comparison with the level achieved in the 10th Five-Year Plan, the productivity of machine tools, forging-pressing machines, and casting and woodworking equipment by 1.3-1.6 times, increasing their reliability and operating life, and raising the precision of machine tools by not less than 20-30 percent.

If we are to create highly productive, precision metalworking equipment, we would need to implement a broad range of scientific research, planning, and design programs; this would include creating and assimilating the production of highly productive machine tools equipped with digital program control, complexes of machine tools and automatic lines equipped with automatic manipulators and program control, and computers and electronic resources intended for the control of such equipment, with the goal of raising the productivity of labor associated with part machining by 1.5-5 times; we would need to produce highly productive forging-pressing equipment, complexes, and sections intended for progressive, low-waste production processes, to include equipment with program control and centralized computer control (this would hasten the reequipment of forging and stamping machine building, raise labor productivity by 1.8-2 times, increase the processing of rolled metal and castings by plastic deformation methods by 1.7 times, insure a 10-20 percent decrease in metal consumption, and eliminate heavy physical and monotonous labor), and so on.

Equipment productivity is to be raised through the assimilation and organization of the production of a broad assortment of metalworking equipment exhibiting improved technical-economic characteristics and intended for various production conditions encountered in machine building and metalworking. Thus in support of small-series and series production, the Srednevolzhsk Machine Tool Building Plant is assimilating production of a semiautomatic chuck lathe equipped with digital program control, and outfitted with an automatic precision class P, 200 mm diameter program-controlled manipulator; the Leningrad Machine Tool Building Plant imeni Ya. M. Sverdlov is assimilating production of jig-boring tools equipped with program control; their precision classes are A and S, the bench width is 1,000 and 1,600 mm, and so on.

Productivity is to be increased in small-series and series production by assimilating and organizing the production of automated sections at a number of machine tool building plants; these sections are to be outfitted with machine tools equipped with digital program control (controlled by computer), intended to work parts of different dimensions. These sections will raise part working productivity by five to seven times in comparison with hand-controlled equipment.

The Ivanovo Heavy Machine Tool Building Plant imeni 50-Letiye SSSR has assimilated production of multistation tools equipped with digital program control and magazines intended for automatic exchange of tools (bench widths are 500, 800, and 1,600 mm). These machine tools perform drilling, boring, milling, and other operations while working box-type machine parts, generally with the part needing to be set up on the machine tool just once. The productivity of such part working with these machine tools is not less than 3.5 times greater than on manually controlled machine tools.

Considering the requirements of large-series and mass production in machine building, significant attention will be devoted to assimilating and producing metalworking equipment. In addition to raising working precision, the level of concentration of production operations, and of mechanization and automation of metalworking equipment will be raised, which will promote growth of such equipment's productivity and insure integrated processing of machine parts. Thus the Khar'kov Machine Tool Building Plant imeni Kossior has started assimilating production of an automatic multiple-cylinder circular grinder equipped with an active dimension monitoring system, an automatic grinding cylinder adjusting device, and a fine-adjustment device, intended for simultaneous grinding of the journals of crankshafts 600-1,250 mm long (radial working precision--0.006-0.01 mm, working precision in relation to shape--0.003 mm, productivity--20 articles per hour). The Saratov Machine Tool Building Plant is planning to assimilate production of automatic internal grinders of precision class A and a grinding diameter of 10 mm, intended to work the openings and shut-off cones of fuel pump sprayers; the Minsk Machine Tool Building Plant imeni Oktyabr'skaya Revolyutsiya will be introducing a semiautomatic crankshaft dynamic balancing machine (the weight of the articles to be balanced is 3-30 kg), and so on.

The level of automation of metalworking equipment is to be raised through the extensive use of electronic systems of program control, which is the most effective means for automating such equipment involved in all of the basic conversions of materials in machine building, to include mechanical working, assembly, forging, pressing, and casting.

Modern microelectronic control resources (microprocessors and large integrated circuits) permit us to dispense with large, unreliable automatic equipment based on relays, and to insure an ever-increasing role for control and optimization of production processes, and flexibility and quick readjustment of metalworking equipment. As an example a high-torque, high-frequency electric drive creates broad possibilities for full automation, for significant growth in the productivity of metalworking equipment, and in a number of cases, for replacement of mechanical gearboxes and feed mechanisms by electric ones. The effectiveness of an electric drive reveals itself most fully on automatic lines, in machine tools equipped with digital program control, and in automated sections consisting of machine tools equipped with digital program control.

In order to support the metalworking equipment production program in the forthcoming five-year plan, associated industrial sectors will have to assimilate and increase production of high-quality complementary articles and materials that predetermine the technical level and competitiveness of the metalworking equipment, to include complete electric drives equipped with 0.18-18.5 kw direct current high-torque electric motors for feed mechanisms, complete electric drives equipped with wide-range motors for main drive mechanisms, complete digital program control systems operating on the basis of microcomputers, microprocessors, and large integrated circuits, programmable control hardware for automatic lines, high-precision bearings, and so on.

Further growth in the production volume of machine building and metalworking in the next few years will be insured through a significant increase in the pool of metalworking equipment without significantly raising the size of the work force to include machine tool operators; growth will also be insured through the use of highly productive metalworking equipment, and through full automation and mechanization of production processes not only in mass production but also in series production. In this case production of highly productive forging-pressing and casting equipment intended for the manufacture of precise blanks will develop at a faster rate.

Production of forging-pressing machines for the manufacture of high-precision stampings, and cold three-dimensional stamping by pressing and upsetting processes, to include stampings made from precision-forged steel, will enjoy further development. Introduction of this equipment will reduce the proportion of nonprecision forging within the total volume of forgings and hot stampings produced.

Expansion of the assortment of forging-pressing machines produced must be combined with continual improvement of the structure of their production, mainly by increasing production of the most progressive and automated equipment. As an example production of forging-pressing machines equipped with program control (including automated complexes), automatic and semiautomatic forging-pressing lines (to include ones equipped with program control), and automation and mechanization resources to support general-purpose forging-pressing machines will grow dramatically.

Production of machine tools intended for mass and large-series production of machine building articles is to develop at an accelerated rate. The production of automatic machine tool lines is to witness greater production of adjustable lines, as well as automatic lines intended for assembly operations.

If we are to upgrade the quality of machine building and metalworking articles, we would need to increase production of high-precision machine tools, and expand the assortment and increase the production of balancing and diamond-boring tools, and jig-measuring and dividing machines. Production of heavy and unique metalworking equipment for heavy, transportation, and power machine building and for other industrial sectors is to expand further.

Experience has shown that one of the most effective ways for automating production processes in small-series and series production is to make broad use of metalworking equipment equipped with program control in machine building; this includes multistation machine tools equipped with magazines for automatic tool exchange; this will make it possible to set up a part on a machine tool once and complete the entire complex of various production operations involving mechanical part working.

Use of machine tools equipped with digital program control increases labor productivity by 2.5-4 times, improves part working quality, and reduces production preparation time by 1.5-2 times.

The effectiveness of metalworking equipment equipped with digital program control can be raised significantly by creating automated sections and production operations outfitted with machine tools and forging-pressing machines equipped with digital program control. A large number of complete automated sections outfitted with machine tools equipped with digital program control, and several sections outfitted with forging-pressing machines equipped with digital program control (computer-controlled) are to be manufactured in the new five-year plan.

The basic and auxiliary production processes are to be combined in all forms of machine building production through the assimilation and production of automatic program-controlled manipulators. This is why our industry must sharply increase production of automatic manipulators equipped with program control for machine tools, for forging-pressing machines, and for casting equipment.

The production potentials of general-purpose machine tools are to be expanded by increasing the number of attachments for them.

An analysis of the machine tool pool would show that we need to change the structure of the metalworking equipment being produced by increasing production of highly productive and precision machine tools and automatic lines, and reducing production of manually controlled machine tools, to include boring, turning-centering, roughing-grinding, and other tools.

Effective use of metalworking equipment in production conditions is inseparably associated with the use of highly productive cutting tools. Tool industry has achieved certain successes in the creation and industrial production of synthetic superhard materials and various cutting tools made from them. A program to create and develop production of precision measurement instruments, to include active control resources and automatic quality control machines, is being implemented.

Large-scale production of new types of tools is to be organized in 1981-1985; such production is to include the use of wear-resistant coatings, tungstenless hard alloys, synthetic diamonds, and other superhard materials.

In order to support production of complementary equipment and its delivery to industrial sectors as requested by the using ministries, the Ministry of Machine Tool and Tool Building Industry will have to develop and manufacture outfits of highly productive metalworking, casting, and woodworking equipment, to include outfits of casting, forging-pressing, and metal-cutting equipment intended to process parts for motor vehicle and tractor internal combustion engines and for heavy diesel engines; crankshafts, camshafts, piston rings, pistons, liners, rods, valves, cylinder blocks, and cylinder block heads; outfits of forging-pressing and metal-cutting equipment producing gear wheels, spline shafts, various types of roller bearings, and vanes for steam and gas turbines and compressors; outfits of machine tools processing parts for the fuel systems of motor vehicle and tractor internal combustion engines and heavy diesel engines, propeller shafts, petroleum pipelines, couplings, drilling pipe joints, and so on. Creation of such equipment will insure integrated preparation of production operations associated with the assimilation and manufacture of new types of machines, equipment, devices, machine units, and other machine building articles, in limited time and with minimum outlays.

The pool of production equipment in machine building and metalworking will be improved by channeling the bulk of all newly produced metalworking equipment into these industrial sectors, and the demand of non-machine building industrial sectors for such equipment is to be satisfied with overhauled machine tools and forging-pressing machines no longer needed in machine building.

Considering the influence of progressive types of metalworking equipment on growth in the productivity of such equipment in machine building and metalworking, capital investments must be channeled primarily into the creation and development of productive capacities that would increase production of machine tools and forging-pressing machines equipped with digital program control, heavy and unique machine and pressing tool production, automatic lines, automatic manipulators equipped with program control, and other types of equipment, instruments, and tools that significantly raise labor productivity in machine building and metalworking.

Any further increase in the technical level and competitiveness of metalworking and casting equipment would be inseparably associated with reinforcement of the scientific research and experimental base of the Ministry of Machine Tool and Tool Building Industry's scientific research and technological institutes. Engineering laboratory buildings must be built and placed into operation at these institutes for the purposes of designing and perfecting new types of machine tools, forging-pressing machines, casting equipment, tools, and instruments.

In addition to developing production of metalworking and casting equipment and tools in the Ministry of Machine Tool and Tool Building Industry, we must also create capacities that would increase production of high-quality complementary articles for metalworking and casting equipment at enterprises of the Ministry of Instrument Making, Automation Equipment, and Control Systems, the Ministry of Electrical Equipment Industry, and the Ministry of Electronics Industry.

The draft "Basic Directions of the USSR's Economic and Social Development in 1981-1985 and in the Period to 1990" and the CPSU Central Committee and USSR Council of Ministers decree "On Significant Improvement of the Technical Level and Competitiveness of Metalworking, Casting, and Woodworking Equipment and Tools" have initiated a new stage in the development of machine tool building.

These paths of further development of machine tool and tool building industry in the 11th Five-Year Plan will promote growth in the country's production of machine building and metalworking products needed by the national economy.

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METALWORKING EQUIPMENT

BRIEFS

INDUSTRIAL ROBOTS--The country's first line of industrial robots has been installed in the presswork building of the Motor-Vehicle Plant imeni I. A. Likhachev. A unique conveyor for servicing robots has been placed in the department. The robots perform all the operations in the new welding section. Semifinished articles--the floor, panels and roof of the ZIL cab are fed at the start of the line, and the finished welded cabs come to the monitors at the end. The worker has taken on the role of operator. He controls the most modern equipment, which represents the latest achievements of scientific thought. In continuing work to rebuild and reequip the capital's enterprises, it is planned this year to accomplish the integrated mechanization and automation of 120 departments and sections, to put 300 automatic and mechanized flow lines into operation, and to introduce more than 5,000 progressive industrial processes. [Text] [Moscow MOSKOVSKAYA PRAVDA in Russian 20 Jan 81 p 2] 11409

MACHINEBUILDING METAL SAVINGS--The Ministry of Heavy and Transport Machine Building, reports deputy minister Ye. Matveyev, has discussed the editorial,"In the Vanguard of Technical Progress," that was published in PRAVDA of 10 March. It noted correctly that the technical level and quality, the high metals intensiveness of certain types of output, and the slow solution of the problems of reducing metal waste do not satisfy the national economy. The ministry has developed and is executing a program for creating new types of machines and equipment of reduced metals intensiveness. Thanks to this, metal savings of 365,000 tons are expected during the 10th Five-Year Plan and 515,000 tons during the 11th Five-Year Plan. The use of new economical shapes and the substitution of the castings and forgings for welded metal structure have brought no small benefit in reducing the weight of products. The editorial also noted that up to 100,000 tons of metal are lost to shavings and chips at Uralmash each year because of the limited number of standard sizes of rolled metal. In order to further improve ways for making parts at Uralmash, automated forging complexes are to be installed, a department for precision castings is to be introduced into operation, and a department for producing metalware is to be created, with the installation of automatic machines that reduce metal shavings and chips 2½-fold. A program for expanding plasma treatment of parts, powder metallurgy, and other new industrial processes also are being solved persistently. An integrated scientific and technical program to reduce manual labor in the industry is being developed for 1981-1985. [Text] [Moscow PRAVDA in Russian 9 Aug 80 p 3] 11409

MACHINE, METALWORKING TOOLS OUTPUT--The 1981 plan calls for a further rise in the technical level of production and quality of the output produced in the capital and the creation and mastery of new types of output that will conform to the latest achievements of science and technology. During the first year of the 11th Five-Year Plan it is planned to master for the first time more than 4,500 standard sizes of output and to remove about 3,500 standard sizes of obsolete items from production. It is planned to increase the output of machine tools with numerical control by 23.9 percent, and of machine tools with numerical program control that are based upon microcomputers and microprocessors 2.7-fold. The output of special, specialized and high-precision ganged machine tools, new types of metalworking tools with the use of wear-resistant coatings, tools for machine tools with numerical program control and automated measuring equipment, and automatic monitoring instruments for metal-cutting machine tools will grow substantially. [Text] [Moscow MOSKOVSKAYA PRAVDA in Russian 28 Jan 81 p 2] 11409

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